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# HERBERTIA

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Journal of the International Bulb Society, Volume 66

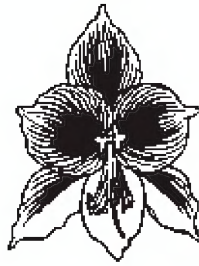
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# **HERBERTIA**

Journal of the International Bulb Society

**VOLUME 66**  
**2012-13**



**International Bulb Society**

P.O. Box 336

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USA

<http://www.bulbsociety.org>

David J. Lehmiller • Editor

**Cover Photo:** *Hippeastrum papilio*,  
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## SPECIAL MESSAGE FROM THE PRESIDENT

The International Bulb Society began as the American Amaryllis Society on May 21, 1933. The Society published its first yearbook in 1934, the low point of the great, worldwide depression. It was called, appropriately enough, **Year Book, American Amaryllis Society**. Sixty one years later in 1995, the Society published its Golden Anniversary Volume 50 issue of *Herbertia*.

Dr. Hamilton P. Traub, one of the founders of the Society and the Yearbook's first Editor, tells us why a new society was begun on page 2 of the 1934 Yearbook in the first two sentences of his 'Editorial Comment': "Some correspondents have wondered why the period of economic readjustment (the Great Depression) was chosen for the launching of the American Amaryllis Society. As a matter of fact, the event was probably in a great measure a coincidence since the interest in plants is only indirectly affected by economic upheavals." In other words, why not start a plant society? People love plants, will grow plants and will seek information about them whether or not times are tough. Dr. Traub continues, "The number of persons interested in Amaryllaceae is undoubtedly great enough to support a thriving organization - not the largest but surely a high quality association."

According to Dr. Traub, "The response (to the new society) was spontaneous and was not only confined to America, but was worldwide. The roster of Charter Members speaks for itself." From his words we learn that the Society had an 'international flavor' from the very beginning, as people from countries throughout the world signed up to become a part of the newly organized American Amaryllis Society.

Dr. Traub neatly sums up the editorial policy of the Society's Yearbook by writing, "The editorial policy of the Yearbook is to publish timely articles, but without too much formality. The Yearbook will be at all times of, for and by the members of the Society. However, when necessary to establish fundamental facts, entirely technical papers will be published." That was, has been and is still our basic editorial policy.

Among the eighty Charter Members of the American Amaryllis Society were members from many states and the District of Columbia, as well as Mr. Basil N. Ikeda of Japan, Mrs. Frank Joyce of Kenya, Mr. E.H. Krelage of Holland, Mr. Kanjiro Okamoto of Japan, The Honorable Henry McLaren of Great Britain, Messrs. F. Rynveld & Zonen of Holland, the Messrs. C.G. Van Tubergen of Holland, and Mr. A. Worsley of England. Distinguished American

names included Mr. Gordon Ainsley, Mr. Henry Buxton, Mr. Richard Diener, Mr. E.G. Duckworth, Messrs. H.F. and Pierre S. Du Pont, Mr. J.N. Giridian, Mr. Wyndham Hayward, Mr. Cecil E. Houdyshel, Mr. E.A. and Mrs. Rufus McIlhenny, Mr. Theodore L. Mead, Dr. Hamilton P. Traub, Mr. Thomas W. Whitaker, as well as the Brooklyn Botanic Garden. Other distinguished names are listed as Charter Members of the Society on pages 4 and 5 of that 1934 Yearbook, but those mentioned will give you an idea of the enthusiasm generated among the gardening elite of that generation 80 years ago.

Since January 28, 1934, the date Dr. Traub wrote the editorial comment quoted from above, the Society has gone from being called the American Amaryllis Society to the American Plant Life Society, and to its present name: the International Bulb Society. We still love the ‘Amaryllis’, but all bulbous plants including bulbs, tubers, corms and rhizomes are now included in our pages as a reflection of our membership’s interests.

The name of our yearbook has changed, too. What used to be the American Amaryllis Society Yearbook was changed after only two years of publication to **Herbertia**. Then **Plant Life**, another publication, came along in 1945 and was published during four years as a separate journal distinct from Herbertia. Plant Life became the Society’s only publication in 1949. In 1984 the name was changed back to Herbertia.

The name ‘Herbertia’ was derived from the surname of The Honorable & Reverend William Herbert (1778-1847), among whose many pursuits was the hobby of growing, observing, hybridizing, grouping, and writing about bulbous plants, especially the Amaryllidaceae. Rev. Herbert compiled his thoughts on this aspect of his plant hobby in Amaryllidaceae which was published in 1837. Although he wrote extensively throughout his life, his book Amaryllidaceae remained Herbert’s major opus.

The International Bulb Society at the seasoned age of eighty years has endured many difficult times, and it has stood proud and tall. Our botanical journal Herbertia is in all her glory, bringing you more articles and news about bulbs, tubers, corms, and rhizomes from distinguished bulb people around the world – larger volumes, more color pictures, and thicker improved paper with UV inhibitors to help our journals last much longer than the originals. The Society and its publications have changed in the past to reflect the needs and interests of our membership. We created the Herbert Award, which is the highest honor the International Bulb Society could bestow upon an individual for meritorious achievement in advancing the



knowledge of bulbous plants; this medal was named for William Herbert whose contributions as a pioneer plant breeder and his arrangement of the Amaryllidaceae helped set the stage upon which other workers, both amateur and professional, have been able to advance. We also created the Hamilton P. Traub Outstanding Service Award in 2000 to recognize meritorious service to the Society; this award was named after Dr. Hamilton P. Traub, founder of the American Amaryllis Society and Editor of its journal for a half century. We delved into a magazine-style publication called **BULBS** from 1999 through 2009 that was in addition to our yearbook *Herbertia*. We also created a Website where members could post color pictures and where we could archive electronic versions of our recent publications.

We have now arrived at difficult financial times in our world of today. Interest is waning in the gardening world. Plant societies are closing throughout the globe as both the serious gardener and the plant hobbyist have become a graying population. Our membership has dropped to a non-sustainable level. Membership/subscription revenues do not cover half the publication expenses of *Herbertia*. Our BX (bulb) and SX (seed) exchanges are the most distinctive exchanges in existence, offering many extremely rare and unobtainable bulbs and seeds seldom offered anywhere else in the world. These exchanges have grossed almost two hundred thousand dollars in donations since 2001 via our Internet Forum. All these funds have been exhausted to support our publications, to host our website, and to keep our society functioning. It is with great sadness that we are not able to continue past 2013. Our Board of Directors met and discussed the future of the Society, and they voted unanimously that 2013 must be our last year of operations. Since 2013 is also our 80<sup>th</sup> Anniversary, I wish to extend my heartfelt thanks to those that have been loyal and dedicated to the Society. All of you helped us achieve our glorious journey through life. You will all be missed, but your loyalty will never be forgotten.

May each person reading these words take a moment to pay a special tribute to the memories of all bulbophiles who preceded us in the work with bulbs, tubers, corms and rhizomes which we have carried forward. May each of us pause and reflect on the rich heritage of eighty years of our Society's work with bulbous plants both rare and common. To you, Rev. William Herbert, and to you, Dr. Hamilton P. Traub, thank you both. The torch you lit and kept alive so many years ago has continued to burn brightly.

— Herbert Kelly Jr., President

## EDITOR'S COMMENTS

I have thoroughly enjoyed being Editor of *Herbertia* for the last five years, a task for which I felt unprepared and reluctantly accepted only at the urging and encouragement of the IBS President, Herbert Kelly Jr. It is with sadness though that I am presiding over the last issue of *Herbertia*, a sadness which many of us old-timers feel at the passing of our era. The Society has been an important part of my life for almost 30 years, just as it has been important for many other bulbophiles. There will be a void which will never be filled again.

As the decision to dissolve the Society was made in December 2012, this created an awkward situation wherein the Society's awards for 2013 had already been presented (well in advance). Consequently, this volume of *Herbertia* carries the label 2012-2013, an addition not only to honor the 2013 awardees, but articles for publication were accepted up through early February 2013, resulting in a larger issue than would have otherwise been published.

Both of our Herbert Medalists (2012 & 2013) have excelled in hybridizing *Clivia*: Victor Murillo of California and Yoshikazu Nakamura of Japan. Many color photos detail a sampling of their accomplishments.

Our Traub awardees have contributed their time and/or resources towards the betterment of the Society. There are two Traub Awards presented for 2012, Manuel Morales of California and Patty Allen of Texas, and the 2013 Traub Award goes to Philip Adams of California who has been the Society's pro bono legal consultant for many years.

Readers will recognize a number of article authorships as they originate from regular contributors, but there are also several articles from first time contributors. Many articles pertain to *Crinum*, there are feature articles on *Scadoxus* and Israeli coastal bulbs, and there are also individual articles on *Hippeastrum*, *Albuca*, *Tulbaghia*, *Biarum*, *Lycoris*, *Narcissus*, *Nerine*, and *Eucharis* – and when combined with the *Clivia* photography of the Herbert Medalists, there is something to interest almost everyone. Several in memoriam articles are also published, and listings of the IBS BX & SX offerings from 2002 through 2012 are provided. We even have a selection of advertisements at the conclusion of this issue, the 80<sup>th</sup> Anniversary Volume.

— David J. Lehmiller, Editor

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## THE HERBERT MEDAL



The Herbert Medal is the highest honor that the International Bulb Society can bestow upon a person for meritorious achievement in advancing the knowledge of bulbous plants. The medal is named for William Herbert (1778-1847), son of Henry Herbert, Earl of Carnarvon. William Herbert had a predilection for amaryllids and achieved success in their hybridization. He published his research findings in several monumental works. His contributions as a pioneer geneticist and plant breeder, and his arrangement of the Amaryllidaceae, helped set the stage upon which other workers, both amateur and professional, have been able to advance.

The Herbert Medal may be awarded annually or on special occasions by the Board of Directors of the Society. Candidates for the Medal are recommended to the Board of Directors by the Awards and Recognition Committee. Medalists need not be members of the Society to be considered for the Herbert Medal. The award includes honorary life membership in the Society.

PAST HERBERT MEDALISTS

1937 Mr. Henry P. Nehrling, Florida	1953 Mr. E. A. Bowles, England
1937 Mr. Theodore J. Mead, Florida	1954 Mr. Thomas R. Manley, Pennsylvania
1937 Mr. Arthington Worsley, England	1955 Dr. Robert F. Hoover, California
1938 Mr. Ermst H. Krelage, Holland	1956 Mr. E. O. Orpet, California
1938 Mr. Cecil Houdyshel, California	1957 Mrs. Morris W. Clint, Texas
1938 Maj. Albert Pam, England	1958 Mr. Wyndham Hayward, Florida
1938 Mr. Pierre S. duPont, Delaware	1959 Dr. Robert G. Thornburgh, California
1938 Mr. Jan de Graff, Oregon	1960 Prof. Ira S. Nelson, Louisiana
1939 Mr. Fred H. Howard, California	1961 Mr. Frederick B. Jones, Texas
1939 Mr. Sydney Percy-Lancaster, India	1962 Dr. Floyd F. Smith, Maryland
1939 Dr. J. Hutchinson, England	1963 Mr. W. D. Morton, Jr., Louisiana
1939 Mr. Carl Purdy, California	1964 Mr. S. Y. Caldwell, Tennessee
1939 Dr. A. B. Stout, New York	1965 Mr. Robert D. Goedert, Florida
1940 Mr. H. W. Pugsley, England	1966 Mr. L. Boshoff-Mostert, South Africa
1941 Mr. W. M. James, California	1967 Dr. M. Cardenas Hermosa, Bolivia
1942 Prof. Dr. A. Fernandes, Portugal	1968 Dr. Robert P. Kahn, Maryland
1943 Miss E. Lawrence, North Carolina	1969 Mr. W. Quinn Buck, California
1944 Dr. Henry A. Jones, Maryland	1970 Dr. Thaddeus M. Howard, Texas
1945 Mr. R. G. Huey, Kentucky	1971 Dr. C. G. Ruppel, Argentina
1946 Mr. Guy L. Wilson, Northern Ireland	1972 Mr. J. L. Doran, California
1947 Mr. R. W. Wheeler, Florida	1973 Dr. Cesar Vargas, Peru
1948 Dr. R. A. Dyer, South Africa	1974 Sr. Pierfelice Ravenna, Chile
1949 Capt. C. O. Fairbairn, Australia	1975 Dr. John M. Cage, California
1950 Mrs. Mary G. Henry, Pennsylvania	1976 Mr. Floor Barnhoorn, South Africa
1951 Mr. Mulford B. Foster, Florida	1977 Mrs. Emma D. Menninger, California
1952 Dr. J. C. Th. Uphof, Florida	1978 Dr. W. S. Flory, Jr., North Carolina

## PAST HERBERT MEDALISTS (cont'd)

1979 Mr. Harry Blossfeld, Brazil	1999 Mr. Fred Meyer, California
1980 Mr. Charles D. Cothran, California	1999 Dr. Peter Goldblatt, Oregon
1981 Mr. W. L. Tjaden, England	2000 Dr. A.A.De Hertogh, North Carolina
1982 Walter & Hilda Latapie, Louisiana	2000 Dr. David J. Lehmillier, Texas
1983 Mrs. A. C. Pickard, Texas	2001 Mr. Graham Duncan, South Africa
1984 Mrs. Marcia C. Wilson, Texas	2002 Dr. Marcel Le Nard, France
1985 Dr. Hamilton P. Traub, California	2003 Dr. Harold Koopowitz, California
1988 Dr. Thomas W. Whitaker, California	2004 Mr. Floris Barnhoorn, South Africa
1988 Mr. Grant E. Mitsch, Oregon	2005 Mr. Herbert Kelly Jr., California
1988 Mr. L. S. Hannibal, California	2006 Dr. Abraham H. Halevy, Israel
1990 Dr. H. Shuichi Hirao, Japan	2007 Mr. Felix Fadjar Marta, Indonesia
1991 Dr. Kenneth E. Mann, California	2008 Dr. Mark P. Bridgen, New York
1992 Mr. Brian Mathew, England	2009 Mr. Joseph Solomone, California
1996 Dr. Maurice Broussard, France	2010 Dr. Ori Fragman-Sapir, Israel
1997 Sir Peter Smithers, Switzerland	2011 Mr. Harry Hay, England
1997 Dr. Dierdre Snijman, South Africa	2012 Mr. Victor Murillo, California
1998 Dr. Alan W. Meerow, Florida	2013 Mr. Yoshikazu Nakamura, Japan

**2012 HERBERT MEDALIST**  
**VICTOR MURILLO**



## VICTOR MURILLO AN AUTOBIOGRAPHY

Soil, water and family – these are the key ingredients out of which my career as a flower breeder have grown. From a childhood spent in the greenhouses of San Diego County, helping my father with his nursery work, to my current status as a Clivia breeder with children of my own, it seems that this simple trio of elements – with more than a little divine guidance – has propelled me into the uncharted terrain of genetic originality on which my career is built.

Family is and has always been first. I could swear it was just yesterday that I was standing up in the front seat of my dad's mustard-colored 1974 Ford Courier as he drove and drove, trying to coax me to fall asleep. I remember having a large Italian sandwich, a small bag of chips, and a large Coke – which I never finished – and it became a fond memory that I will never forget. I was born on December 12, 1974 at the UCSD Medical Center in San Diego. I am the older of two children. My mother, Angelina Mendez Miramontes, was born in Zacatecas, Mexico on November 5, 1948, and she raised me and my sister, Melissa Murillo, who is 27 years old.

My father, Victor Caldera Murillo, was born in Canoga Park, California on July 28, 1936, and he grew up in the San Fernando Valley. He started his adult life early, living on his own from the age of 16. He finished high school, but that was the extent of his education – money was tight, so work came first. Being one of seven children, Dad needed to help out when it came time to pay bills and to feed the brothers and sisters. He worked odd jobs, finally taking an interest in agriculture, and eventually he became heavily involved in the nursery industry.

One of his first jobs was with a lily grower, Dahlstrom & Watt Bulb Farms, Inc., located in Smith River on the border between California and Oregon. Bob Miller, the owner, was Dad's mentor, and Dad gained a lot of practical knowledge from Miller that he continued to use throughout his years of growing. Dad moved to Southern California and worked at a few different nurseries, later meeting my mom in Fallbrook, California. Mom was one of seven children also, having come to the U.S. at the age of 15. She attended Fallbrook Union High School but unfortunately did not graduate. She worked in the strawberry fields as a young lady and became involved with agriculture not really by choice, but by necessity.



It was at a nursery in Fallbrook called Good Earth that my parents met in 1972. By that time, Dad was a foreman and managed 90 people.

When I was 10 years old, my dad was offered the opportunity to manage a 30-acre nursery, an already well-established foliage nursery named Pacific Foliage which was located outside Escondido, California. My father's job description was to manage the nursery, but we also were able to live on the property and to enjoy the beautiful scenery. When I heard the news, I jumped up and down – not at the idea of living at a nursery, but upon hearing a description of the area. There was a total of 30 acres of land with a little pond, and I remember riding my bike to the rims! During this time, I attended Bonsall Elementary School during the day, and when I returned home I would look through the nursery for my dad, to see how I could give him a hand. I remember running into one greenhouse and coming out the next. To this day I still love the smell of fresh potting soil.

During this time, my father also had the opportunity to rent a small greenhouse just down the street from us, which allowed him to do his private growing. It was a pretty good-sized green house that was well-equipped, just waiting for somebody to start filling it up. Mom and Dad discussed it, and a week later the contract was signed.

We named our fledgling family operation A & M Nursery – after Angelina and Melissa, my mom and sister. We grew some amazing Pothos, Marble Queen, and China Doll. During this time, we were also buying plants to resell from other nurseries, including Sunlet Nursery, with whom I would later be working. We lasted a few years at Pacific Foliage, but eventually the nursery was sold due to financial problems. I still have fond memories of that beautiful nursery. Part of my heart was left there when we moved back to Fallbrook.

After that, my father left the nursery industry and started a landscaping business. (By this time, I think Dad was fed up with managerial roles in the nursery industry and was ready to become his own boss.) Of course, I was there to help out on the weekends. A couple years later I began attending Fallbrook High School, where I joined the agriculture program and raised a couple of steers for show. I really wasn't into the horticulture part of the program at the time – I think the animals really just attracted my attention.

I later went on to junior college and finished a year of classes before beginning my first job hunt in March of 1996. I had recently welcomed a baby boy, Isaiah, into the world – and with him I accepted the

responsibility of fatherhood. During my search I saw a help-wanted ad in the paper, a sales position at a plant nursery, and as soon as I saw it I called and lined up an interview. I was called back for a second interview and eventually was hired.

I have now been at Sunlet for 14 years as of March 2010, and I have had the privilege of working under excellent mentors – counselors that I can honestly say have been an honor to learn from. John and Janet Kister are two of the hardest-working individuals I have met. I am very proud to say that I have learned the sales aspect of growing from Janet, and I am continually learning the production aspect, little by little, from John.

I started as a sales rep for Sunlet and eventually became Inventory Control Manager, a liaison between sales and production. I am now in charge of Inventory Control on 25 acres. I also do all the major purchasing of boxes, sleeves, pot covers, etc. It's a full-time job to say the least!

I was introduced to beautiful Clivia in 1997 by John. He and a friend of his, Eric Anderson, had already been working on hybridizing a Peach Clivia, and I was asked if I wanted to continue the breeding program. I agreed, and in 1998 I started a serious breeding program with notes, measurements, photographic documentation and other tasks, such as collecting and storing pollen and tagging plants. When John introduced the program to me, he mostly let me learn for myself. He'd give me a heads-up on what to with some minor guidance, but most of the notes were my own (thank God I did them myself).

I was taking this breeding program very seriously – to an extreme, perhaps. But I would later discover that it had all been worth it.

January 2001 brought the first bloom of the long-awaited breeding program. Specifically, the wait had been for that beautiful Peach Clivia to bloom, an heirloom of beautiful flowers.

Once the first seedlings started blooming, it was if I had been holding a big breath of air and was able to exhale only with the opening of the first flower. A soft sigh followed, as a sense of accomplishment came to my heart. My crosses, annotations and photography paid off as we saw the first Clivia bloom Peach. Not only was I surprised, but so was John. To make a long story short, my crosses bloomed true and the plant was eventually named after me and trademarked by Sunlet Nursery.

I was introduced into Clivia in 1997, bloomed my first hybrids in January 2001, and attended my first Clivia Symposium in March 2001 at

the Huntington Library in San Marino, California. I had been breeding *Clivia* for three years and knew nothing about the plant – nor that there were collectors, enthusiasts and crazy people with collections worth thousands of dollars. (I also didn't know that I would eventually become one of those crazy people.)

I had the honor of meeting Tino Ferrero at the Symposium that year, as well as Jim Comstock, Harold Koopowitz, Randy Baldwin, Joe Solomone, Manuel Morales (Joe Solomone's son-in-law) and Dr. Earl Murphy, with whom I later became good friends. From then on, I was meeting *Clivia* people from around the world. I joined the *Clivia* enthusiasts group moderated by Pen Henry and Rudo Lotter. Their group was very welcoming and I learned a great deal in a short period of time. Meanwhile, I continued to breed plants at Sunlet and started to buy seeds and plants via the Internet and E-Bay, adding to my personal *Clivia* collection.

I later joined the North America *Clivia* Society and the *Clivia* Society from South Africa. When I started my *Clivia* collection, I was living in a small, two-bedroom apartment, and I soon had seedlings growing on top of my fridge, in my small back yard, and on the front porch. Luckily, I only lasted a few years at the apartment, and I still remember my then-girlfriend, Danielle, saying to me: "Babe, one of these days we're going to buy a house and you'll have all the room you want for your plants."

Needless to say, I married her. In June of 2003, Danielle De La Llave and I were wed at the historic San Luis Rey Mission in Oceanside, California. We bought our first home in November 2003, and my *Clivia* collection entered a new phase of expansion. Danielle has always played a very important role in my *Clivia* breeding program: From the beginning of our courtship, I would talk her ear off regarding *Clivia* – what new plants were blooming, for example, and the new crosses I was working on. On a few occasions, she had to tell me to forget about *Clivia*: "Let's talk about us," she'd say. The lesson I have learned is that, if you have a supportive spouse when it comes to plant collections, hang on to that special person!

Eventually I started to buy a good portion of my breeding plants and seedlings produced at Sunlet for my private holdings. The collection grew again, and that's when Murillo's Exquisite *Clivia*'s (M.E.C.) was born. I started my breeding program with a singular goal in my heart: To create the best *Clivia*'s in the world. Murillo's Exquisite *Clivia*'s was founded in 2003.

Over the next few years, I saw hundreds of seedlings bloom, from Peaches to Pastels to beautiful Pinks. Little did I know that my Green Yellows, such as ‘Green Clouds’ and ‘Vic’s Green’ were going to become some of the best Group-1 Green Yellows in the world.

Meanwhile, I have continued to build relationships with Clivia people from around the world. In late 2004, I was asked by Dr. Harold Koopowitz to speak at the Huntington for the following year’s Clivia Symposium. I gave my presentation in March 2005 alongside such great speakers as Keith Hammett of New Zealand and Ken Smith from Australia. I also met Jim Folsom from the Huntington Library, who asked if I would be interested in displaying some of my Clivia in the gardens. I was delighted. I now have a section of my named clones at the Huntington, and we are continually adding more here and there. Every spring, my family and I go to the museum to see our beautiful plants in full bloom. This is one of our family’s biggest accomplishments – placing our plants in a beautiful, prestigious museum where our children – and, eventually, our grandchildren – could see the work of our hands in full bloom.

My Clivia hybrids continued to receive national and international attention in magazines and newspapers, to the extent that I was invited to talk at the 2006 International Clivia Symposium in Pretoria regarding my breeding experience with the Clivia ‘Victorian Peach’. In September of that year, my wife and I traveled to South Africa for the Symposium. Africa has to be one of the most beautiful places on this earth, from the wildlife, to the habitat plants, to the humble people. I felt like I was at home.

One point I really want to make is regarding my age: During this time I was 32 years old, and was being asked to talk about my breeding program in front of a few hundred people – people who had been breeding Clivia for longer than I had been alive. An honor? Absolutely! And a blessing from God – something for which I could never thank Him enough. My presentation lasted 45 minutes; when those minutes were up and I said thank you, the best feeling was seeing my wife’s face. She was saying, with a look, that she was very proud of me. The standing ovation and all the attendees who came up to congratulate me on my breeding program were the icing on the cake. It felt rewarding to observe Clivia breeders from around the world admire my work, and to see that they wanted to build Clivia relationships to acquire some of the genetics I had been producing as a young man.

Over the last few years, I have continued to expand our Clivia production with new crosses, by dividing plants, by naming the new “Exquisite” hybrids, and by registering them with Australia’s Clivia Registrar, Ken Smith. We built a reasonably spacious shade house and a good-sized greenhouse to produce a few thousand seedlings annually. We also partnered with two distributors that wanted to promote our material worldwide: James and Connie Abel from South Africa and Ken Smith from Australia. David Bearlin of Burwood Clivia Nursery is now taking over distributing in Australia.

Every spring, I take a stroll through my Clivia grounds, talking to my plants and listening to music, preparing them for their blooming period. Once you see the first scapes come up, you start feeling that sensation that runs through your soul: In a few weeks you’re going to see a range of beautiful colors. A large umbel blooming for the first time – or is it a repeat bloom from that plant currently ranking with some of the best Clivias in the world? Whenever I’m feeling down or have had a long day, a little time with the Clivias seems to cheer me up.

True to my own upbringing, M.E.C. maintains a family-oriented Clivia breeding program, including the efforts of my wife, Danielle, first son, Isaiah, and now our little one, Noah, who was born in August 2009. Even he, now 18 months old, likes to walk around with his little water wand and help out. He might not know what he’s doing yet, but give him a couple years. Each member of our family plays a part of what people see when I post pictures on the Internet of beautiful plants that are in bloom. We are all watering, repotting, collecting pollen, cleaning berries, and packing seeds and plants to ship worldwide. If not for my family’s support, this program would not exist.

I want to take this opportunity to say thank you to all the people that have supported my breeding program throughout the years. I have learned a lot from other Clivia breeders, collectors and friends. There is no way we are going to please all the plant people around us – absolutely no way. A good, true friend once told me: “Forget about the people who talk bad about you; you’ll get sick if you dwell on those unhappy people. Work with your Clivia because you enjoy working with them. You don’t have to prove anything to anybody; your work speaks for itself.” I especially want to thank my family, as their hard work has helped us produce wonderful plants for the world to enjoy. Last, but certainly not least, I want to give all

glory and credit for these beautiful plants to our Lord Jesus Christ. This all could not be possible without His magic touch. For the last three years we have dedicated our blooming season to God, to say thank you for all that He does for us. This award is dedicated to Jesus Christ for his wondrous work he has done in our lives.

I have listed a few of my named clones below in the Table. These represent only a portion of my hybrids – as new seedlings come to age and flower, they each will have their own identity. My breeding program/ collection has surpassed my expectations; my Clivia's continue to surprise me every year. Theories are constantly being proven wrong and new findings are opening new doors for new colors and new traits. This beautiful plant has built bonds for us all over the world. I would like to thank my family – my wife Danielle for being there from day one, my son Isaiah who helps me do the dirty Clivia jobs, and Noah for helping me hold the hose when I'm watering. Thank you guys for the support and love you have showed me through these years as our Clivia program has grown.

### **All subsequent photographs by the author**

#### **ARTICLES**

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**TABLE 1. NAMES CLIVIA CLONES**

A Bouquet for Elise	Green Runner
Alicia	Green Scene
Angel's Smile	Heaven's Garden
Angelina	Heaven's Gate
Baby Ribbon Pink	Heaven's Light
Baby's Breath	Isaiah's Daruma Peach
Bamboo Breeze	Jesabella
Been Away	Kaya
Bette Mae	Lara
Blushing Lady	Liquid Gold
Clouds of Joy	Love and Peace
Cream Swan	Malayah
Cup of Tea	Mali
Danielle	Mali' Sister
Danielle's Desire	Mariah
Danielle's Joy	Mary
Danielle's Smile	Mayah
Dolores	Missing You
Elise	Medium Pink 2005
Faith Series (Variegated Pinks )	Missing You
Faith 08-01	Monster Peach
Faith 08-02	Morning Smile
Faith 08-03	Multipetal Peach
Faith 08-04	Mystic Light
Family Love	Noah's Peach
Fanning Green	Ojos Verdes
Footprints	Pastel of Fun
Forgiven	Peach Elegance
Fratzy Peach	Peach Feathers
Gold/Peach	Peach Swan
Gravity Green Boy	Pink Blush
Green Clouds	Pink Clouds
Green Eyed Lady	Pink Diamond
Green Fluff	Pink Fantasy
Green Mist	Pink Fascination
Green Nugget	Pink Passion

Pink Picottee  
Playing Hoops  
Prince of Hope  
Pure Platinum 01  
Pure Platinum 02  
Reche Pad  
Rosarito Mornings  
Santos  
Sharon's Yellow  
She's a Beaut  
She's a Blessing  
She's Blushing  
She's a Little Shy  
She's Mine  
She's on Fire  
Shooting Stars  
Showing Off  
Sol  
Sundance  
Sunshine  
Sweet Dreams  
Sweet Glow  
Sweetness  
Thinking of You  
Victor's Alida  
Victor's Cherri  
Victor's Daruma like Peaches  
Victor's Extreme Green  
Victor's Green  
Victor's Group 2 Yellow  
Victor's Henriette Peach  
Victor's Little Girl  
Victor's Mini Peach  
Victor's Pastels  
Victor's Picasso  
Victor's Petite Yellow  
Victor's Pinks

Walking on Clouds  
Waves of Glory  
Waves of Strength  
Xochitl  
24 K  
98-40 Lt Peach Green throat



**Fig. 1.** 'Angel's Smile'.



**Fig. 2.** 'Baby's Breath'.



**Fig. 3.** 'Bamboo Breeze'.



**Fig. 4.** 'Blushing Lady'.



**Fig. 5.** 'Cream Swan'.



**Fig. 6.** 'Faith 08-02', setting seed in the foreground.





**Fig. 7.** 'Forgiven'.



**Fig. 8.** 'Green Clouds'.





**Fig. 9.** 'Green Nugget'.



**Fig. 10.** 'Green Scene'.



**Fig. 11.** 'Heaven's Garden'.



**Fig. 12.** 'Heaven's Gate'.



**Fig. 13.** 'Heaven's Light'.



**Fig. 14.** 'Mary'.





**Fig. 15.** 'Medium Pink 2005'.



**Fig. 16.** 'Missing You'.



**Fig. 17.** 'Mystic Light'.



**Fig. 18.** 'Peach Elegance'.



**Fig. 19.** 'Pink Blush'.



**Fig. 20.** 'Pink Diamond'.





**Fig. 21.** 'Pink Fascination'.



**Fig. 22.** 'Pink Passion'.



**Fig. 23.** 'Rosarito Mornings'.



**Fig. 24.** 'She's a Beaut'.





**Fig. 25.** 'She's Mine'.



**Fig. 26.** 'Sol'.



**Fig. 27.** 'Sunshine'.



**Fig. 28.** 'Sweetness'.



**Fig. 29.** 'Thinking of You'.



**Fig. 30.** 'Variegated Pink Fantasy'.





**Fig. 31.** 'Victor's Cherri'.



**Fig. 32.** 'Victor's Extreme Green'.



**Fig. 33.** 'Victor's Green'.



**Fig. 34.** 'Victor's Henriette Peach'.



**Fig. 35.** 'Victor's Little Girl'.



**Fig. 36.** 'Walking on Clouds'.



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YOSHIKAZU NAKAMURA



**Fig. 1.** Yoshikazu Nakamura holding a variegated daruma.

# YOSHIKAZU NAKAMURA

## A BIOGRAPHY

by Helen Marriott  
Melbourne, Australia

### INTRODUCTION

Yoshikazu Nakamura is the foremost breeder of *Clivia* in contemporary society, and he has influenced *Clivia* growing and breeding throughout the world during the past 20 or more years. In particular, his sharing of superior *Clivia* which he bred with South Africans who were members of the nascent *Clivia* Club/Society (which was formed in South Africa in 1992), as well as with others in Australia, Europe and the USA during the 1990s, has contributed immensely to interest in, and advances in the breeding of this genus during that decade and in the one to follow. He is truly revered by the *Clivia* fraternity throughout the world and has no rival in this regard. For many of us, it is indeed such a great honour to know this individual and his great contribution to *Clivia* development.

### NAKAMURA'S LIFE-LONG COMMITMENT TO *CLIVIA*

Yoshikazu Nakamura was born on November 28, 1949 in the city of Mobara in Chiba prefecture, Japan, which is southeast of Tokyo. He was the second child and only son of Chu and Kimi Nakamura. His family was a horticulturally-oriented one. His father was an eminent horticulturalist specializing in rice. Chu Nakamura lived at a time when rice cultivation was very important in Japan, and he developed new cultivation methods and made other discoveries for which he received many awards. After this he specialised in flowering plants such as *Amaryllis*, *Dahlia*, *Hibiscus*, *Narcissus* and *Erythrina*.

Nakamura's school education also contributed to his interest in plants. He recalled learning about a method of how to grow chrysanthemums while at primary school, and at middle high school he joined the gardening club (clubs being an important part of educational institutions in Japan). He subsequently entered an agricultural high school, and after graduation, worked at a company for some years.

In 1975 he learned from his father that Isamu Miyake, a renowned nurseryman and bulb and rhizome specialist who lived close to the Nakamura family, possessed a yellow-flowering *Clivia*, so he went to see it



and at that time received one precious berry as a gift. By 1980, he recalls that at the time his salary was around 60,000 yen a month, but that he was spending around 100,000 yen on *Clivia*. While still working full-time, he also started to work part-time for Miyake, who, in fact, had earlier been trained by his father, Chu Nakamura. Nakamura learned a lot about growing plants from Miyake and still regards this mentorship as very important in his life and continues to refer respectfully to the latter.

It was while working at Miyake's nursery that Shuichi Hirao (1990 Herbert Medalist), a renown plantsman in Japan (whose main breeding focused upon *Iris kaempheri*, but who also had interest in numerous genera, including *Clivia*), suddenly passed away at the age of 68 years in 1988. Hirao's various plant collections were then dispersed and Miyake arranged for Nakamura to purchase the *Clivia* collection soon after that time. Nakamura indicated that this collection contained many "ordinary" *Clivia* which he guessed were given as presents to Hirao from local visitors, but it also included an offset of *C. miniata* 'Vico Yellow' which came from the plant Hirao had received from the late Sir Peter Smithers (1997 Herbert Medalist). Nakamura subsequently used 'Vico Yellow' extensively in his breeding programs, right up until the present time, and the large flowers and full umbels for which he is renowned must he attributed to this breeding material.

Nakamura commenced his own *Clivia* business in 1986 and although it also functioned as a wholesale and retail (including mail order) outlet, in the main his greenhouses were important space for his *Clivia* breeding. His family residence and nursery/greenhouses, known as the *Kunshiranen* (formerly *Kunshien*) or the *Clivia* Breeding Plantation, are still located in Mobara city in Chiba prefecture.

In 1995, he extended his growing areas by renting some nearby land and began growing seedlings in tunnels. There he grew *Clivia miniata* and other interspecifics and sold them to the wholesale market in Tokyo. On one occasion he was unable to sell seedlings of *C. miniata* x *C. gardenii* and Miyake arranged for him to sell them to Thompson and Morgan in the UK.

During this period, although his competence in foreign languages was minimal, he travelled overseas because of his interest in *Clivia*. He first went to China, visiting Shanghai over 25 years ago and on subsequent trips visited to Changchun, Dalian, Harbin, Dandong and Guangzhou. He visited Australia in 1992 and 1993, and then South Africa in 1994 and 1998,

where he attended the first two international *Clivia* conferences, giving an illustrated introduction of his own breeding on the first occasion (see Nakamura, 1998). He subsequently maintained contact with many overseas breeders and enthusiasts of *Clivia* and was very generous in the photos and other *Clivia* memorabilia that he sent people.

Nakamura always placed importance on observing and learning about the original habitat of plants and believed that Japanese and Chinese growers, along with others, should visit the South African habitats of *Clivia*. In fact he believed that Chinese *Clivia* growers would especially benefit from contact with South Africa and other countries by extending their focus on foliage and paying more attention to flower forms. Nakamura actually attempted to influence *Clivia* growing in China by donating 10,000 yellow hybrids to the city of Dalian in 1997. However, he was aware that the interest of Chinese specialist breeders was upon smaller plant form and broader leaves, and to this day he does not know if his gift of long-leafed, yellow-flowering *Clivia* was appreciated or not (but he suspects the latter).

Of considerable importance was Nakamura's avid collection of different genetic material from abroad during the 1980s but more especially the 1990s. It must be realised that this was still a very early period historically in the contemporary development of *Clivia*, and Nakamura probably built up a better collection of *Clivia* material from around the world during this period in comparison with any one else in Japan or overseas at the time. In 1992, he wrote as follows in the publication of the Royal Horticultural Society:

I make a point of obtaining every new cultivar or variant possible and trying out every conceivable breeding technique. I am not aiming at mass cultivation but am committed to continuous observation....

The more I study the breeding of *clivias* the more pleasure I find in promoting their strong points and caring for their development. (The Garden, August 1992, p.371)

Nakamura maintained early contact with Cynthia Giddy in South Africa and exchanged plants and seeds with her. On one of his visits to South Africa he obtained 'Chubb Peach', an important peach cultivar, and then bred peach plants from this, crossing it with 'Vico Yellow' or superior hybrids developed from the latter. He also obtained three peaches (and peach-like colours) from the USA, including 'Tessa' and 'Helen', which

he used in his breeding. Another important plant that he added to his collection was *C. miniata* 'Vico Gold' which he received directly from Sir Peter Smithers in 1993. At one stage, he almost lost this plant because of rot, but it recovered and Nakamura contributed an important offset to a recent charity auction in May 2011 (see subsequent article by Sasaki).

In terms of the huge developments made in *Clivia* breeding in the past two or more decades, Nakamura must be credited with the early establishment of a varied collection, as stated above. His assembly of a wide range of *Clivia* for breeding purposes included the pendulous species which were available to him – *C. caulescens*, *C. gardenii* and *C. nobilis* – and later *C. robusta*. After its discovery in 2001 and subsequent release to the public, Nakamura was able to obtain *C. mirabilis* from the South African National Biodiversity Institute in 2005. At the time, he expressed his interest in observing the characteristics of this species and began to plan its hybridization. Many people have had difficulty growing this slow-growing plant with special cultivation needs and thus, so far, Nakamura has not yet seen a flower on his *C. mirabilis*.

Nakamura's excellent breeding results were already evident in the photos contained in The Garden issue of 1992, mentioned above. Furthermore, in 1993, Keith Hammett, a plant breeder from New Zealand, testified to the diversity found in Nakamura's collection (Hammett, 1994). Contrary to collections found elsewhere at the time which were invariably only of *C. miniata*, Hammett observed a variety of leaf forms, different forms of variegation as well as specimens of the pendulous species. Nakamura has actively cultivated such hybrids over a long period of time and from them has produced new types of *Clivia* which had not existed hitherto. These plants have been sought after by overseas enthusiasts in various countries, including South Africa, with the result that there are now collections of Nakamura hybrids in various countries around the world.

Nakamura joined the *Clivia* Club, the predecessor body to the *Clivia* Society, which is based in South Africa but has an international membership, as one of its very first members and his major contribution to *Clivia* has been recognised with the awarding of Honorary Membership. All the Yearbooks of this *Clivia* Society to date display photos of his plants and numerous *Clivia* pictures posted to the Yahoo *Clivia*-Enthusiast Group as well as the *Clivia* Forum have some Nakamura breeding in their background. I was privileged to summarize the contribution which

Nakamura has made to Clivia breeding at the Clivia Society's International Conference held in Pretoria, South Africa, in 2006 and following the conference presentation, also submitted an illustrated article to the yearbook, *Clivia* 8 (see Marriott, 2006). Subsequently, in 2010 I delivered a presentation on the heritage of Clivia in China and Japan, where, of course, Nakamura's accomplishments were described as pivotal (Marriott, 2010).

Nakamura has contributed not only through his breeding but he has also disseminated knowledge of Clivia growing and breeding in three languages: Japanese, English and Chinese, where texts in the latter two languages were translated into those languages. In the early years of the Clivia Club/Society, he contributed not infrequently to the newsletters and yearbooks. He has similarly contributed articles on Clivia in Japanese and Chinese garden magazines (see reference list for samples).

Also of great importance is the fact that in the 1990s and first half of the following decade, Nakamura disseminated his plant material to certain Clivia growers overseas, often in the form of seed, even if in relatively small quantities. This meant that enthusiasts and emerging breeders in South Africa, Australia, USA, UK and elsewhere gained access to high quality Clivia material, upon which numerous growers and breeders have continued to build. It is not an exaggeration to state that Nakamura provided extremely vital stimulation to Clivia growing in South Africa, the original home of the genus.

In his seminal publication on Clivia, Harold Koopowitz (2002:176) described Nakamura as an "international ambassador" for Clivia, stating that he had been exposing and introducing Japanese clivias in their myriad forms, flower colors, and plant shapes to other growers around the world. He has also sold and shared seed – spreading enthusiasm and good will for Clivia around the world.

Since 2005, Nakamura has suffered from severe arthritis and so because of severe physical limitations, he has had to drastically reduce the amount of Clivia cultivation and breeding which he undertakes. He has also given up the additional growing areas that he had been maintaining. Nevertheless, his commitment to Clivia has not diminished and he continues each year to make new crosses and sell seeds and plants on a more limited scale.

In describing some significant events in his own life, Nakamura gives the year 2000 as the time when he first met Shigetaka Sasaki. Sasaki worked

in the horticultural industry and after deepening his knowledge of *Clivia* through his contact and subsequent mentorship under Nakamura, became deeply committed to growing and breeding *Clivia* himself. With knowledge of English and the ability to network effectively with people around the globe, Sasaki has made known the work of Japanese breeders, especially Nakamura (see Sasaki, 2000), to the English-speaking *Clivia* community. Furthermore, in 2011 and in response to the horrendous triple crisis – earthquake, tsunami and radiation leaks – which occurred in northeastern Japan on March 11, 2011, Sasaki gathered donations of top quality *Clivia* from seven leading Japanese hybridizers (including himself) and made these available through a *Clivia* Charity Auction on eBay International on May 22, 2011. On this occasion, Nakamura donated a very important offset of ‘Vico Gold’, with the winning bid reaching US\$1,402.35. See the following article by Sasaki on Nakamura’s contribution of ‘Vico Gold’.

#### NAKAMURA’S *CLIVIA* BREEDING ACCOMPLISHMENTS

A leading characteristic of Nakamura’s breeding is its diversity. In the sections to follow I will introduce his breeding of *C. miniata*, especially though use of the hybrid, ‘Vico Yellow’, interspecifics, mulitpetals and variegates.

#### *CLIVIA MINIATA* BREEDING WITH ‘VICO YELLOW’ (FIG. 2-12)

In order to improve the flower form and flower size of *Clivia* which existed in Japan at the time (smallish, orange-coloured flowers from Belgian hybrid stock), Nakamura utilised *C. miniata* ‘Vico Yellow’, mentioned above, in much of his hybridization work. On the basis of the many hybrids which have arisen from this breeding, we must certainly acknowledge that the selection of ‘Vico Yellow’ as a main parent was remarkable. It was actually Hirao who first identified the potential of ‘Vico Yellow’ when it first flowered for him in 1984. When it flowered for Nakamura himself, it was the largest *Clivia* flower he had seen up until that time, and it possessed good flower form and had somewhat reflexed tepals with a kind of frill or wave. It also had a strong peduncle and long pedicels to support a substantial umbel. Nakamura soon discovered that these characteristics influenced the production of distinctive hybrids. In 2006, Nakamura stated, “Even though I was impressed with ‘Vico Yellow’ twenty years ago, it’s still an impressive flower. I think I will feel the same way in another 20 years.”



From among his ‘Vico Yellow’ crosses, many outstanding plants have arisen (see yearbook *Clivia* 12:81 & 83). These have often been given a simple descriptor such as ‘Vico Yellow’ hybrid (usually yellow), ‘Vico Yellow’ hybrid orange (in the case of an orange-flowering plant) or ‘Vico Yellow’ hybrid pastel. He also often refers to hybrids from this breeding as “best yellow”. Nevertheless, some of the exceptional ones have been given cultivar names, including ‘Chiba Yellow’ and ‘Chiba Orange’. Nakamura has observed that these plants often surpass the parent ‘Vico Yellow’ in terms of the size of their flower, and excellent flower form with reflexed tepals. Waved or rolled flowers have also emerged from this cross (see yearbook *Clivia* 3:24-29, photos 30-33).

A distinctive feature throughout a lot of Nakamura’s breeding was his frequent use of an orange and yellow *C. miniata* as the seed (or pod/berry) parent. In fact, much of his breeding with ‘Vico Yellow’ involved its use as the pollen parent, crossed onto an orange plant split (homozygous) for yellow. ‘Chiba Lily’ (with a flower diameter of 13-14cm) was selected from such a cross, as was ‘Chiba Gold’, a deep yellow-coloured *Clivia* with fine broad petals and reflexed tepals. Other striking flowers also emerged from this cross, such as his ‘Striped Petal’ which contained a whitish stripe running down the centre of the tepal, and various ‘Ghost’ colourings (also known elsewhere are water colours or particolours). Unusual bicolours also emerged from the combination.

In 2004 Nakamura distributed seed of the cross [(orange *miniata* x yellow *miniata*) x ‘Vico Yellow’] x picotee, illustrating his continued development of further variations of his fine hybrids. These plants produced bi-colour or picotee-like flowers, with improved flower form because of the ‘Vico Yellow’ in their parentage. Crosses involving ‘Chubb Peach’ with ‘Vico Yellow’ also resulted in superior flowers in terms of size and shape, compared with many of the hybrids arising from ‘Chubb Peach’ when crossed within the group in South Africa. He also made hybrids of ‘Chubb Peach’ and ‘Vico Gold’.

#### **MULTIPETALS/POLYTEPALS (FIG. 13-17)**

*Clivia* flowers normally possess six tepals; however occasionally a plant will spontaneously produce flowers with more tepals. Within the *Clivia* community when most or all flowers in an umbel are of this type, these plants are usually categorized as multipetals or polytepals (and occasionally

the term “double” is used, either as a synonym or as a sub-group).

Nakamura was one of two known Japanese *Clivia* growers who purposely assembled a small number of multipetal *Clivia* and then bred them together to produce fine orange-flowering multipetal *C. miniata*. It was Nakamura, however, who then sent some of his multipetal seed overseas, so these days certain growers in South Africa, Australia, USA and elsewhere have multipetals in their collections thanks to the breeding and distribution of Nakamura.

Needless to say, some extremely fine flowers have arisen from his crosses (see yearbook *Clivia* 8:6 & 13). Probably the best internationally well-known multipetal hybrid is “Woodland Grande Multipetal” grown by Ian Brown in South Africa from Nakamura seed (see yearbook *Clivia* 3 cover & inside page). It has been the Show Winner of several Cape Club annual *Clivia* shows held in Cape Town, South Africa, and its progeny are highly sought after in South Africa and elsewhere. Laurens Rijke in Melbourne, Australia, is also growing a fine collection of multipetals, thanks to the breeding of Nakamura (see website of Melbourne *Clivia* Group at <http://www.melbournecliviagroup.org.au/gallery.html> under specialty galleries [Polytepals Laurens Rijke]).

Although in the early period of this hybridization of multipetals, Nakamura invariably crossed orange multipetal with orange multipetal, producing 100% multipetals, in more recent years to extend the range of hybridization he has been crossing one multipetal parent with a six-petalled flower such as ‘Vico Yellow’. Although the F1s have only six petals, it is expected that through sibling crosses, the F2s will exhibit the multipetal characteristic and that the colour range will be greatly extended to include yellows as well as pastels and other variations.

The breeding and production of multipetal *Clivia* still remains very small scale but where individuals or rare specialist breeders are working on further developing this category, it appears that often their original material originally came from Nakamura, either directly or through third parties.

#### INTERSPECIFICS (FIG. 18-25)

Another area of *Clivia* breeding where Nakamura made outstanding achievements was in relation to interspecific hybrids. The early cross made in Europe of *C. nobilis* and *C. miniata*, which was known as *C. x crytanthiflora*, was found in many countries but this was often the only

interspecific, albeit an old one. Even so, interspecific hybridization still only existed on a very limited scale world-wide, but Nakamura wished to make full use of the characteristics found in the different species and their combinations. As mentioned above, Nakamura utilized the upward facing *C. miniata* in various combinations with the pendulous species – *C. caulescens*, *C. gardenii*, *C. nobilis* (and *C. x crytanthiflora*) and more recently, after it was named as a separate species, *C. robusta*.

In South Africa there was one family (Lötter) of *Clivia* breeders who hybridized interspecifics but their range was mainly limited to use of two pendulous species (*C. gardenii* and *C. nobilis*) and neither did they produce the complex types of hybrids bred by Nakamura. Nakamura started breeding interspecifics about 20 years ago, at first using *C. nobilis* as the pendulous species with *C. miniata*. He continued to work with this combination (see *Clivia* 7:46). However, more than anyone else he fully utilized *C. caulescens* to produce exquisite *C. caulescens* interspecific hybrids (see *Clivia* 8:8 & 14).

One of Nakamura's most magnificent interspecifics was 'Day Dream' produced from a cross of (orange *C. miniata* x yellow *C. miniata*) x (*C. caulescens* x yellow *C. miniata*) about 20 years ago (see *Clivia* 8:50). 'Day Dream' was featured in various Japanese and English *Clivia* publications and its pollen was used by Nakamura and others to further produce highly worthwhile interspecifics. Rijke was also fortunate in growing a large amount of Nakamura interspecific seed and selected out and named many highly desirable plants. Among them, the plant which attracted world-wide attention around 2005 was 'Clementina', thought to be F2 *C. miniata* x *C. caulescens*, but it could have been another combination, such as the interspecific backcrossed again to *C. miniata* (See *Clivia* 7 inside cover & p.30 & *Clivia* 8:14). With its main colours as yellow/cream, orange and green it was most unusual for an interspecific because of its spherical umbel, obviously deriving from its *C. miniata* heritage (see website of Melbourne *Clivia* Group at <http://www.melbournecliviagroup.org.au/gallery.html> under specialty galleries [Interspecifics Laurens Rijke]).

Possessing an excellent form of *C. caulescens* which produced lovely round tepals in its progeny, Nakamura produced many splendid *C. caulescens* interspecifics, as stated above. But he did not stop with only producing the primary interspecifics or F2s. Rather he used a wide range of combinations, thus producing much more variation in the resulting flowers.

For example, he bred such interspecifics as (*C. miniata* x *C. gardenii*) x (*C. caulescens* x *C. miniata*). Furthermore, using an interspecific such as 'Day Dream' he bred complex crosses resulting in different interspecific flower forms, as in [(orange *C. miniata* x yellow *C. miniata*) x 'Vico Yellow'] x 'Day Dream'. The results of this latter cross produced a wide variety of flower colours – orange, orange with a prominent white contrasting throat, yellow and even greenish colours, while the flower shape revealed the influence of 'Vico Yellow' (See *Clivia News* 19:4, front cover).

By using the pendulous species which frequently have green-tipped flowers, Nakamura has been able to increase the colour range in interspecific flowers.

Nakamura's crosses involving *C. gardenii* have also become well known. 'Moonchild' (*Clivia* 7:15), for instance, has a distinctive flower with a contrasting inner colour and with flowers which are held rather horizontally when in bloom. Other *C. gardenii* interspecific hybrids may be semi-pendulous or take on some other form. In early 2010, Nakamura flowered one of his own interspecifics which emerged from a 2004 tray labelled as "my breeding mix" which he subsequently named as 'Venus' (See *Clivia* 12:87). Based on the form of the plant and its leaf, as well as flower shape, he believes that 'Venus' emerged from a *C. gardenii* cross. Around the same time, Nakamura actually made the cross of (orange *C. miniata* x yellow *C. miniata*) x (yellow *C. miniata* x *C. gardenii*), and it is possible that 'Venus' might have come from such a cross.

Nakamura also sometimes selfed his interspecifics for the purpose of stabilizing the characteristics of the plant and bringing out recessive features. Knowledge of how to develop worthwhile interspecific hybrids was quite scarce but Nakamura was able to contribute in this regard. For instance, in 1994, he recommended backcrossing with a like type. Using yellow *C. miniata* as an example in interspecific hybridization, he suggested such combinations as (yellow *C. miniata* x *C. caulescens*) x yellow *C. miniata* or (yellow *C. miniata* x *C. gardenii*) x yellow *C. miniata* (*Clivia Club* 3:7). The outcomes of such crosses produced larger-sized interspecific flowers which, not unexpectedly, exhibited a range in their coloration and tepal shape.

In order to increase interest among the Japanese public in the little-known interspecifics, sometimes in the past Nakamura has given out two-year old seedlings of special interspecific crosses to his customers

with the hope of attracting people to a wider range of *Clivia*. What is probably still not realised is that by possessing a variety of interspecifics, growers are able to enjoy *Clivia* flowers throughout 12 months of the year, particularly made possible because of the reblooming characteristic of interspecifics involving *C. caulescens* and *C. nobilis* or *C. x crytanthiflora*. In Melbourne, Australia, for instance, I now enjoy *Clivia* flowers every month of the year, thanks largely to the interspecific breeding of Nakamura. The extension of the flowering season in this way constitutes a very significant accomplishment. Nakamura, himself, wishes to enjoy *Clivia* flowers throughout many months of the year and so continues to strive to produce a broad range of these interspecific hybrids.

### **VARIEGATES (Fig. 26-30)**

Perhaps because of his Japanese heritage where there has been interest in variegated plants, Nakamura has also fully grown and hybridized various types of *Clivia* with variegation in their leaves. He has been working on variegates from an early period right up until the present in mid 2011 (at the time of writing). Although interest in variegation is also found among some growers in China, Nakamura probably stands apart for his combined interest in both the flower and the leaf variegation.

With regard to *Clivia*, Japan was, and remains, far ahead in the development of various variegated forms of *Clivia* (though some may argue that China is a rival). For instance, in 1994, Nakamura introduced to the *Clivia* Club the different types of variegates which were found in Japan at the time (*Clivia* Club 3(5):5), and he followed this up with a more detailed set of drawings four years later (*Clivia* Club 7(1):14-16). Needless to say, variegates emerged from among the seed which he sent to South Africa. (For a time in the 1990s, this seed was in exchange for the Japanese translations of the English *Clivia* Club newsletters by a translator who was based in South Africa.)

While Nakamura also grows and sometimes breeds with the more commonly occurring *striata* type of variegation, it is the rarer forms which take pride of place in his own greenhouses, especially *akebono* variegation (see *Clivia* 8:17) and in more recent years, *Light of Buddha* variegates which originated in China. Nakamura has worked with *akebono* variegation for about 25 years and by crossing these with 'Vico Yellow', he has produced magnificent specimens of long-leaved plants with fine yellow



or pastel flowers. Actually, the first yellow *akebono* which he produced (no doubt the first in the world) was flowered in South Africa by Connie and James Abel in 2000, from seed which they received from Nakamura when he stayed with them on an earlier visit. Nakamura's first yellow flower bloomed in 2002 in his own greenhouse. *Akebono* variegation is maternally inherited, and thus by crossing (*akebono* x yellow *miniata*) x yellow *miniata*, Nakamura was able to produce yellow as well as pastel flowers. In the past he has also made an interspecific cross using an *akebono* plant, but these are very rare.

Over the past decade or so, Nakamura has built up a collection of Chinese Light of Buddha plants, which also possess horizontal banding, like the *akebono* variegation, though there are also some differences. Originally, Nakamura thought that the Light of Buddha plants were stronger and thus easier to grow, though of late he has reversed his opinion in this regard. Again, he has crossed them with 'Vico Yellow' and various other combinations and looks forward to producing a wide range of Light of Buddha hybrids in the future. This year he undertook a lot of crosses of Light of Buddha x *C. nobilis*, in order to produce variegated plants which would flower during winter or at other times of the year.

One type of variegation in Japan which can only be produced vegetatively through offsets is *fukurin*, or albomarginated variegation (apart from extremely rare spontaneous appearances from seed). Nakamura sometimes employs a cutting method in order to increase offsets but more commonly purchases plants from a merchant who handles such plants. Nakamura thus always has *fukurin* variegates available for sale from his nursery.

While I think it is reasonable to conclude that Nakamura's predominant interest lies in the flower, he is also obviously interested in other plant characteristics, such as leaves and plant form. In 2004, the Japanese garden magazine *Shizen to Yasei Ran* (The Wild Orchid Journal) contained an article on *Clivia* variegates. Using plants in his own collection, Nakamura contributed photos on *Clivia* foliage and plant forms on this occasion.

#### SUMMARY/CONCLUSION

Nakamura has actively promoted *Clivia* for his entire adult life and still continues to produce new and diverse hybrids. His huge contribution to

international Clivia breeding came at the early stage of the “revolution” which has characterised Clivia growing and breeding in the past two decades. People from various countries have benefited immensely from his accomplishments, including South African and other international breeders and growers of Clivia. He has no rival.

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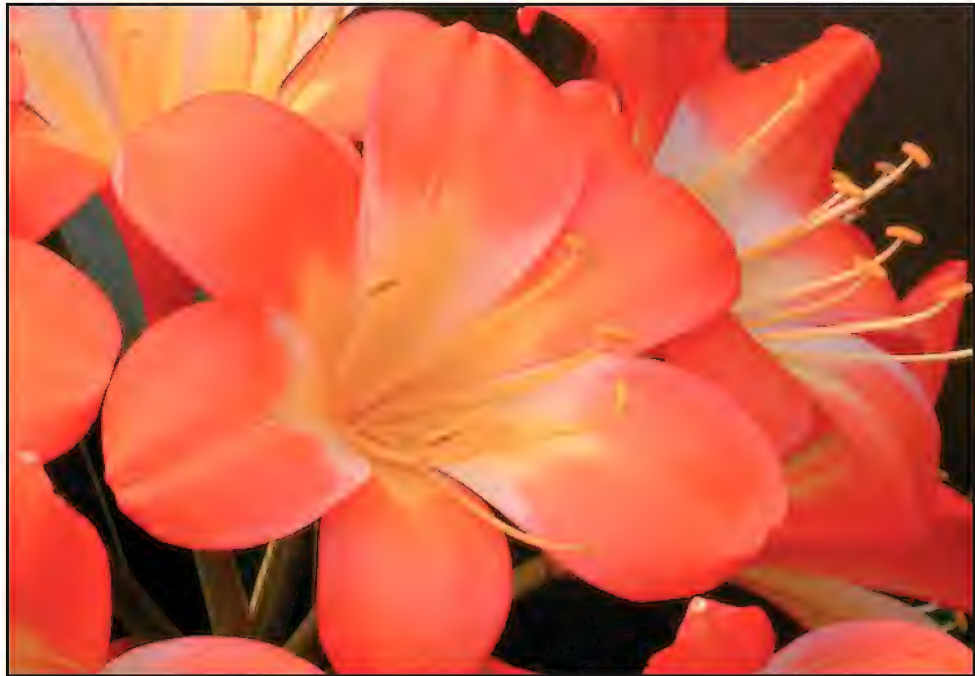
**Fig. 2.** 'Tiffany', a 'Vico Yellow' hybrid.



**Fig. 3.** Yoshikazu Nakamura's greenhouse & a 'Vico Yellow' hybrid.



**Fig. 4.** 'Lunar-Smile', a 'Vico Yellow' hybrid.



**Fig. 5.** A 'Vico Yellow' hybrid orange.





**Fig. 6.** A 'Vico Yellow' hybrid.



**Fig. 7.** 'Chiba Gold', a 'Vico Yellow' hybrid.





**Fig. 8.** A wavy form of a 'Vico Yellow' hybrid.



**Fig. 9.** A pastel 'Vico Yellow' hybrid.



**Fig. 10.** 'Ghost' colouration.



**Fig. 11.** 'Striped Petal'.



**Fig. 12.** 'Chubb Peach' x 'Vico Gold' hybrid.



**Fig. 13.** A multipetal hybrid.





**Fig. 14.** A multipetal hybrid with a large contrasting throat.



**Fig. 15.** A reddish multipetal hybrid.



**Fig. 16.** A small cupped multipetal hybrid.



**Fig. 17.** A multipetal hybrid.



**Fig. 18.** 'Clementina', a *Clivia miniata* x *C. caulescens* interspecific hybrid.



**Fig. 19.** A *Clivia miniata* x *C. nobilis* interspecific hybrid.





**Fig. 20.** 'Mandala', a *Clivia miniata* x *C. caulescens* interspecific hybrid.



**Fig. 21.** 'Day Dream', a *Clivia miniata* x *C. caulescens* interspecific hybrid.



**Fig. 22.** A *Clivia miniata* x *C. caulescens* interspecific hybrid.



**Fig. 23.** 'Yellow-Delight', an interspecific hybrid.



**Fig. 24.** 'Gay Delight', an unusual interspecific hybrid.



**Fig. 25.** 'Green Splendour', an interspecific hybrid from *Clivia miniata* x *C. gardenii*.



**Fig. 26.** A variegated multipetal.



**Fig. 27.** A yellow variegated multipetal.



**Fig. 28.** A whitish *akebono* (probably from the influence of 'Vico Yellow').



**Fig. 29.** *An akebono*  
variegate.



**Fig. 30.** *A fukurin*  
variegata in Nakamura's  
collection.

## **YOSHIKAZU NAKAMURA'S DONATION OF 'VICO GOLD' FOR THE CLIVIA CHARITY AUCTION 2011**

**Shigetaka Sasaki**  
Mobara, Japan

News about the big earthquake and tsunami which occurred in Northeast Japan on March 11, 2011 was broadcast widely on TV and Japan became the focus of the world's attention.

Yoshikazu Nakamura, who lives in Chiba prefecture, was not directly affected by the earthquake or the tsunami, but like many other people every day he watched the broadcasts of the tragic disaster-stricken area. He was particularly captivated by the video of one young girl.

This young girl was carrying in both hands some sweets and took them to the cashier, holding out a 1,000 yen note and said: "These please." But then she quickly reconsidered: "No, I don't want them." She put the sweets back on the shelf. Then, handing over the 1,000 yen note, she said: "Please donate this." The girl, rather than buy sweets for herself with the money, instead made a donation to the people of the disaster-stricken area.

Mr. Nakamura saw this image and said to me: "There was no other calculation in this child's contribution; she did it purely to help the victims. On this occasion, large contributions have been made by companies and individuals, including famous people, but the contribution of this girl's 1,000 yen has the value of 100 million yen." Having approached Mr. Nakamura about the Clivia Charity Auction to collect funds for the disaster victims, on that occasion he said that he would donate 'Vico Gold'.

Mr. Nakamura had received 'Vico Gold' from Sir Peter Smithers who said: "Please use this in your Clivia breeding." Mr. Nakamura had planned to sell an offset of this for his own profit, but he thought: "If I don't benefit someone through this, just like the girl did, then Sir Peter Smithers, who will be watching from heaven, will ridicule me." Then he said: "But I have one hidden agenda. I believe that people will become more interested in Clivia if I donate 'Vico Gold' to the Charity Auction."

'Vico Gold' had never been sold before, so the first time for it to be priced was at this Charity Auction. Because 'Vico Gold' was a sibling of 'Vico Yellow', it belonged to Group 1 yellow, but its special feature as breeding material was that it had a whitish, pale tendency in comparison

with usual yellow hybrids of orange or other colours. Even though it was called "gold", its colour was "near white". From Mr. Nakamura's cross of 'Chubb Peach' x 'Vico Gold', quite a whitish, not yellowy, light peach arose. Furthermore, from his cross of (Akebono orange x yellow) x 'Vico Gold' he also bred an almost pure white Akebono yellow.

I truly hope that the person who purchased this famous flower will acquire the same feelings Sir Peter Smithers and Mr. Nakamura have had for 'Vico Gold'.

**THE HAMILTON P. TRAUB AWARD FOR DISTINGUISHED SERVICE**

This award was established in 2000 by the IBS Board of Directors to recognize meritorious service to the Society. It is named after Dr. Hamilton P. Traub, founder of the American Plant Life Society, antecedent of IBS, and editor of its journals for a half century.

**PAST RECIPIENTS**

2000	Mr. Charles E. Hardman	2008	Mr. William T. Drysdale
2001	Mr. Marvin C. Ellenbecker	2009	Mr. Tony Palmer
2002	Mr. Michael G. Vassar	2010	Mr. Herbert Kelly Jr.
2003	Dr. Alan W. Meerow	2010	Mr. Robert Thompson
2004	Dr. David J. Lehmiller	2011	Mr. John Leonard Doran
2005	Dr. Charles Gorenstein	2012	Mr. Manuel Morales
2006	Mrs. Pamela J. Kelly	2012	Mrs. Patty Allen
2007	Mr. Karl E. King	2013	Mr. Philip R. Adams





## 2012 TRAUB AWARD MANUEL MORALES



**Fig. 1.** Manuel Morales holding his Traub Award following presentation by IBS President Herbert Kelly Jr. on September 27, 2011.



## MANUEL MORALES AN AUTOBIOGRAPHY

Manuel Morales was the fifth child of twelve born to a ranch foreman and his wife in Jalisco, Mexico in 1951. When he was very young, he wanted to become a rancher. However, Manuel's parents wanted him to receive an education so he was sent to live with relatives in town where he could attend school. After several months of homesickness, he ran away and found his way back to the ranch. Eventually Manuel did complete two years of grade school during his convalescence from a ruptured appendix at age 15.

As an eight year old, Manuel delivered milk into town for his family. During his daily trips, he bought bag candy and sold it by the piece to children on the ranch. He was trying to make the money he knew he needed to fulfill his dream of ranching. In this way Manuel saved enough money in a year to buy a female piglet. The next year that pig delivered a litter of eight. He sold six piglets for one hundred pesos apiece and kept two females for breeding. By selling piglets he accumulated enough funds to purchase a heifer cow when he was eleven years old. He bred the heifer, sold the males and kept the female offspring. When he was seventeen he had accumulated a herd of fifteen milking cows and had earned enough money to travel to the United States. He intended to work in the United States, to save his money, and to buy a ranch in Mexico. At age 20 he obtained a permanent job at S&S Nursery Growers. In 1977 he became a legal U.S. resident. In seventeen years' time, Manuel was able to make each of his family members legal U.S. residents.

With a regular job Manuel was able both to save money and to send some back to Mexico to help support his family. In 1982 he sent fifteen hundred dollars back to his mother and father. His father, who was a lifetime alcoholic, lost all of this money in a bar. After receiving a letter from Manuel saying that he would not help his family anymore if he continued drinking, his father stopped and has remained sober for twenty-eight years.

In 1975, after working in the fields for four years, Manuel obtained his Class A License and began making deliveries for the nursery. Two years later, when both of the company's salesmen quit, he convinced Joe Solomone (2009 Herbert Medalist) to let him try his hand at sales.

Unwilling to let him try because he was illiterate and spoke broken English, it took a month of Manuel's persistence before Joe relented in exasperation. During his first two weeks at sales, Manuel sold over thirty thousand dollars while still making deliveries. Over the next fifteen years he was consistently the top salesman, and in 1988 he received the Salesman of the Year award from the California Association of Nurserymen.

As a result of his wide range of jobs at S&S Nursery Growers, Manuel was able to master many skills that enabled him to become a successful nurseryman. In 1988 he and his partner, Luen Miller, bought Monterey Bay Nursery and made it the successful business that it is today.

Manuel is well known and respected throughout the nursery industry.

**2012 TRAUB AWARD**  
**PATTY ALLEN**



## PATTY ALLEN AN AUTOBIOGRAPHY

I was born in Fisher County, Texas on November 24, 1933. My father was a peanut and cotton farmer, and my mother was a housewife who tended four daughters, an orchard, a vegetable garden and a flower garden. I was the third born daughter, and evidently I inherited my mother's love of plants. However, my mother passed away when I was just six years old.

When I was eleven years old, my family moved to Spring, Texas, just a few miles north of Houston. There I attended junior high school and graduated from "Carl Wunsche Sr. High School" with second highest honors.

I have always possessed the ability to draw well and planned to become a fashion illustrator when I graduated, but things happened! I met my husband-to-be during my junior year, and upon graduation in May of 1951, we were married on June 23.

On the 5<sup>th</sup> of August 1952, my handsome son was born, and by July 1958, the last of his four pretty sisters had been born. With my priorities changed, I cared for my family ... thoughts of a career were far from my mind. As the children grew older and I had more free time available, I rediscovered my childhood interest in plants and bulbs and started growing a few things that appealed to me.

In 1974, as the children began to go out on their own, I decided if I couldn't have the "illustrator career" I had desired years ago, then I would focus my talents on painting. So I enrolled in oil painting classes, followed by watercolor classes. I later expanded into pastel, acrylic and scratch art painting. Over time, I became an art teacher and conducted classes in oil and watercolor painting. I conducted workshops in pastel and scratch art. After joining different art societies, I won numerous 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> Class Ribbons and probably sold over 325 paintings, including several commissioned paintings.

In 1987 my interests took another turn, and my passion for growing things resurfaced and commanded center stage. I began acquiring as many different kinds of hardy bulbs as I could that would grow and increase in numbers without a lot of "fuss and bother". Thus was born my "Bayou City Heirloom Bulbs Nursery" – the name Bayou City is synonymous with Houston as we have five bayous flowing through Harris County. I



became passionate about learning all I could about hybridizing different kinds of bulbs. Because I didn't have the time to spend at a structured learning facility, I turned to books and trusted horticulture friends and the Internet for the background information I required. I also gleaned a lot from local old-time gardeners – one can't go wrong listening to “first-hand” information!

The very first beauties that caught my eye were Amaryllis (back then I didn't know they were properly named *Hippeastrum*). From there I turned to Daylilies (didn't know they were *Hemerocallis* until later). That led to Oxblood Lilies (learned they were *Rhodophiala*). Then came the little Rainlilies (*Zephyranthes/Habranthus*). I noticed plenty of pretty white and yellow/white flowers blooming on property where old homes had been demolished, and that translated into rescue missions to salvage Daffodils (that's what most Southerners call *Narcissus*). I became involved in trying to see how many varieties of Daffodils I could successfully grow here in Southeast Texas, my home since 1948. Most people think there are only 6-7 kinds of Daffodils, but I grow at least 37 varieties.

Bearded Irises do not grow well in our “neck of the woods”, but they are beautiful and I keep on trying. I have succeeded in coaxing a few varieties into liking our climate, and I am continually trying out different varieties, hoping to provide people in Southeast Texas with a larger pool from which to select. However, Louisiana Irises are another thing altogether! Our climate was made for them, so of course I am pursuing some hybridizing with them as well. There is so much excitement in crossing one bulb with another one and then waiting for your “children” to arrive.

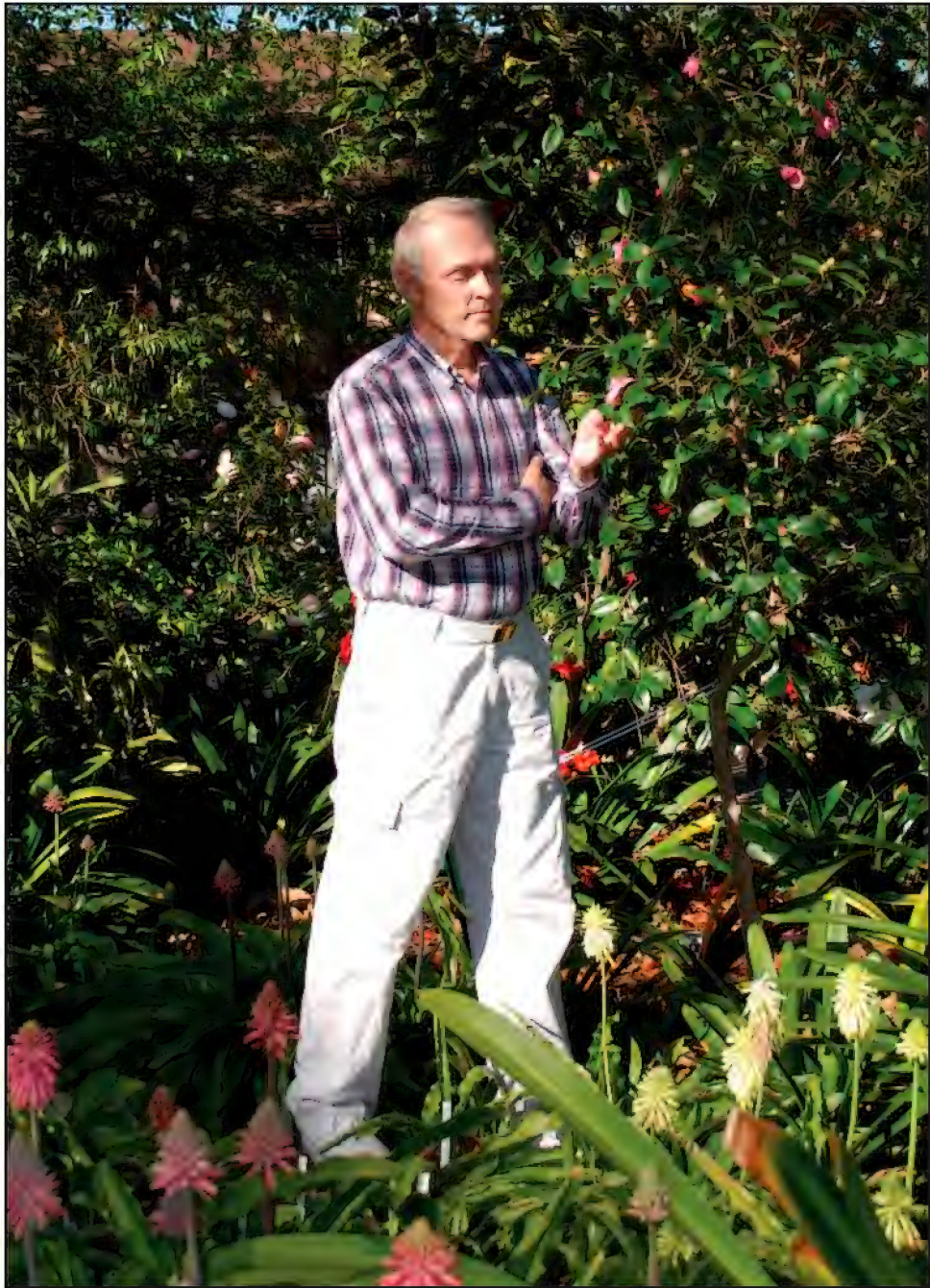
As I said previously, I don't have any formal education in the plant world, but I do have 30 plus years of “on the job training”, and that speaks volumes.

Joining the International Bulb Society in 2004 was one of the most exciting moves I have made. I have learned about so many different bulbs I had never heard of before, along with having the opportunity to purchase these bulbs, learn their culture requirements, and yes, do some more hybridizing!

I do know that gardening is very beneficial to your health. You get exercise for which you don't have to pay anything, you get spiritual strength from your commune with nature, and should you be in need of psychotherapy ... you can forget all your cares and woes with a good day's work in your garden, and you aren't out a big bill to pay!

Every person who loves to “play” in the garden and enjoys seeing their plants & bulbs increase in size and number, ought to enjoy hybridizing .... if you haven’t tried to do any hybridizing, you should because it’s fun! I have three seedlings from a cross of a *Habranthus* and a *Rhodophiala* that I hope will grow to blooming size in about 3 years; I’ll post a photo on the e-mail Forum when one does bloom!

2013 TRAUB AWARD  
PHILIP R. ADAMS



## PHILIP R. ADAMS AN AUTOBIOGRAPHY

It is not an insincere statement of humility that I offer to readers my wonder in having received this award! I have through the years, with this Board of Directors as well as earlier ones, offered little bits of legal advice and counsel. At these times, when I was a practicing attorney in Los Angeles, California, I felt somewhat confident in offering legal guidance to smooth over various affairs that almost all such organizations encounter. If this input of mine formed a placid sea for sailing into the future, then I am pleased. A lingering satisfaction is that most of my counsel seemed to have been considered.

Legal advice is tricky, as surely we all know. When there is a questionable behavior or corporate decision at issue, the avoidance of a lawsuit should be the goal of most in the legal profession. And so it has been with my input. There was, however, one situation that could not avoid a vigorous pursuit under the law. But I did not legally serve as a litigator in the matter, as it involved an area of the law that was certainly outside my expertise. Other than that, I have always endeavored to calm prickly situations and upset feelings so that the business of the Society could proceed unimpeded. It must be noted that California Rules of Ethics very strictly prohibit any publicizing of legal matters such as this, and I have steadfastly maintained the required silence of identifying particulars.

In regards to pro bono legal counsel and activities, I brought some background to the table. Without going into detail, I will simply relate one particular achievement that afforded me a “background of fire” in working with charitable organizations. In 1988 I was awarded the “man of the year” for my work with the Imperial Movie Capital Court of Hollywood. I obtained legal charitable status for this organization that had the goal of serving – both financially and otherwise – children with AIDS in California. This devotion came at a time when government help for this stricken and lamentable class was grossly lacking, and the IMCCH was a lifeline to so many. My work with the IMCCH put me into direct and almost daily contact with movie stars, politicians, and surreptitious maneuvering of board members who were trying to take control. It was all quite a veritable minefield of human love and otherwise!

But perhaps readers will more appreciate my interest in plants. My first



such memories, at the age of three in 1945, were of a visit to my paternal grandparents where I was introduced to the intoxicating fragrance of *Narcissus jonquilla* blooming in their yard. About the same time at my maternal grandparents I was shown the large groundcovers of native violets growing in the yard. The lesson to all of us may possibly be that children need imprinting with the fascinations and beauties of plants at a very early age – a lesson in appreciation that seems limited in this modern time.

Throughout high school years I was not overly enamored of botanical matters. But when I returned home in late September of my first year at the university, some strange and intense consciousness overtook me as I looked around the 10-acre yard at the hundreds of *Lycoris radiata* var. *radiata* in full bloom. At that moment, I was overwhelmed by their exotic beauty and mystery of bloom. That first horticultural epiphany has stayed with me all my life, and the result is the article on *Lycoris* that appeared in *Herbertia* Vol 65:108-233.

As the years proceeded I never gave up a deep interest in *Lycoris*, and my interest spread to other plants as well. While my studies at the university led me to a master's degree in sociology (cum laude), then later to a Juris Doctor Degree in law (top quarter), and even winning in competition the Federal Republic of Germany one year all expenses paid educational trip to Germany, my horticultural interests continued unabated. I taught on the collegiate level for two years and then moved to California where I worked as editorial supervisor for six years with Commerce Clearing House, the world's largest and most respected legal-tax publishing company. In my sixth year, I passed the California bar exam and began work with a law firm in Beverly Hills.

All in the meantime, I joined local horticultural organizations. I even drove to San Diego and met Dr. Thomas Whitaker (1988 Herbert Medalist) who helped me select a complete set of Plant Life, etc. On several occasions I spoke extemporaneously at the Southern California Horticultural Institute meetings, always attended by several hundred people.

My interests in the world of horticulture expressed itself in my life memberships in both the North American Lily Society as well as the American Daffodil Society. In working with *Lilium*, my goal was to hybridize toward true lilies that would ramp in the Zone 10 climate of Los Angeles. After the fourth generation of killing thousands of seedlings, I am happy to say that I am growing numerous true lilies here that are simply

not supposed to be grown here.

My goal with daffodils has been to preserve historically important species (mostly) by digging them from endangered and abandoned house sites. My many springtime trips around the Memphis, Tennessee, and Midsouth areas have resulted in transplanting thousands of *Narcissus pseudonarcissus* and *N. jonquilla* (both the early and the late forms) to my family home where they are planted in large drifts along the 150 foot length of the driveway. A thrill of some 10 years ago was finally finding the abandoned and overgrown house site where “Silver Bells” was growing by the score. This little alabaster white trumpet daffodil with the downfacing flower is now rare and hardly ever seen. “Silver Bells” is not *N. alpestris* but is almost assuredly some very old and vigorous hybrid that looks about the same.

My interests also have been in finding and preserving rare or unusual bulbs. My horticultural mentor Mrs. Hortense Tidwell (deceased at the age of 95 in 1990) of North Mississippi finally, after many years of steadfastly refusing to do so, shared one bulb of her prized crinum. It is surely a hybrid, barely surviving in the cold winters of Zone 7b, but now doing better in California’s Zone 10. After 30 years of growing it, the three bulbs I have would seem to represent a true labor of love in keeping it alive. Its fragrance is so overpoweringly delicious that its presence in this more congenial location is worth the effort to make sure it prospers.

There are other horticultural projects. I am trying to create a *Hippeastrum* that looks exactly like *H. cybister* but that is entirely at home outside in my climate. As you all must have experienced, *H. cybister* is exceedingly difficult to grow and to bloom. A complex hybrid blooming in this spring of 2012 has finally given me the bulb that may fit my hopes. Also, some 200 bulbs resulting from *H. papilio* pollinated by *H. cybister* will bloom the spring of 2012, and I have high expectations that a fertile hybrid might emerge with all the strengths of the capsule parent and the morphology of the pollen parent.

I have dabbled in growing *Clivia miniata* var. *aurea*. My group of parents gives all-yellow seedlings and most have wider segments than commonly are seen. My most immediate attempts are to create full-yellow, downfacing flowers such as found in *Clivia* x *cyrtanthiflora*. This project is still underway.

I have tried to create more cold hardy *Nerine* by intercrossing just those

that survived my sometimes frosty winter nights. It can be done, as about 55 bulbs have emerged after 15 years of trying to satisfy the goal – even if by only a couple of degrees!

For some 10 to 12 years I operated a huge daylily hybridizing program back at my family home. Growing the 25,000 to 30,000 seedlings each year to provide the breaks finally became impossible to maintain due to the declining health and abilities of my family and local help. I have a debt of gratitude to my 91 year old mother that I am incapable of repaying. But Adams daylilies are growing in most states of the nation as well as in other countries.

From the great Polly Anderson, a plantsperson of the first order who is now deceased, I obtained most of the special *Amaryllis belladonna* bulbs that I used for some 35 years in hybridizing. As the selections, results, and natural increase in plants had become a burden on the limited space of my garden, I am glad to say that the entire collection (except for 55 retained selections) are now growing in a respected arboretum. Those who have actually seen the bulbs in bloom have stated that they represent one of the finest collections of them – but then again, perhaps I am biased!

Currently I am avidly pursuing *Veltheimia bracteata*. It grows with such a natural abandon at my home that it is a pleasure to see it go from good to better each year. Several hundred seedlings – from three or four bulbs I obtained years ago from Len Doran – are now producing subtle color variants that are exciting and deeply satisfying to see. This is a species that desperately needs the attention of growers such as was afforded to it during Victorian times; it is an indoor glory and in Zones 9 and 10 climates is just as good outdoors.

My family home just south of Memphis, Tennessee, is too cold to grow *Camellia japonica*. But I was determined to see if it could be done. After purchasing the entire set of the camellia yearbooks, I researched and found the 10 to 20 most cold hardy japonicas known – in both flower and plant. After I found and planted seven of them, all but three were killed by the Midsouth winters. The three surviving ones – now 12 feet tall – are worked by scores of bees each spring, and I have removed the resulting young seedlings to various places in my family home. Now, 47 cold hardy *Camellia japonica* bushes are prospering there. Most bear commonplace flowers, but three or four are surpassingly attractive and being professionally propagated for possible commercial introduction. In

that climate a japonica that even survives is good to have.

For some time I pursued hollies. Now, I have established at my family home 16 *Ilex opaca* (American holly) trees – all the best named varieties I could find.

I also sought out and found some of the most northerly growing (and cold tolerant) *Magnolia virginiana* var. *australis* (in the extreme north of Mississippi and across the border into Tennessee) and painstakingly gathered its seed when I could. The commercial variety ‘Henry Hicks’ remains a large shrub while the more usually found variety *australis*, becomes a large evergreen tree up to 50 feet tall and more, and bears flowers with a heady fragrance like sweet lemon. The *australis* variety should be extensively sought and planted wherever it can be grown. Through my efforts, eight seedling trees are now prospering and blooming at my family home.

And if I have not driven you all to distraction, I have one more horticulturally interesting tale if you can follow along just for a few more moments. When exploring the woods in the central part of my home county in Mississippi just two miles north of my family home, I discovered a hickory tree that was “different” from any other hickory that I had ever seen. It was in a 100-year old cemetery and jammed next to a large oak tree. The nuts it was producing were huge and delicious but extremely hard to crack. I determined it was a *Carya laciniosa*, the “Shellbark” or “King Nut” hickory. (Those interested may read about it in Wikipedia.org.) This species, however, is almost nonexistent in the state, maybe just a total of six to ten rare trees to be found in isolated locations; its normal range is mostly from Missouri eastward to Ohio with other colonies in nearby states. How could I have found such a tree and an associated population!

The tree expert for the state of Mississippi made the 225 mile trip to determine if I, indeed, had found the species in a new state location. His pronouncement was both of surprise and delight. I had found much the largest known population of the species in the state. In fact, it occurs over a distance of about 10 to 12 miles but mostly as rather isolated trees and not in groups. I have gathered the huge, delicious nuts – when I have been able to get ahead of ravenous squirrels – and learned how to sprout them. Now, at my family home, six of these magnificent native trees are prospering along with named commercial selections.

So as you see, my life interests have been both legal and horticultural.



It is only natural that I should have found the IBS and been a member for more years than I can relate. In fact, I think I must now be considered one of the “old guard”, and I am proud to have known so many of those great pioneers that now we only occasionally read about. I have retired from the practice of law and gifted my law library to two different institutions. I no longer render any kind of legal counsel – whether by written brief or by simple verbal opinion. But I will certainly remain a part of the horticultural world as long as I live. In that frame of mind, I sincerely thank the Board of Directors for bestowing on me the honor of the Hamilton P. Traub Award.

**THE ENIGMA OF *CRINUM UNIFLORUM* F. MUELL.  
(AMARYLLIDACEAE) AND THE JUSTIFICATION FOR  
TWO NEW AUSTRALIAN *CRINUM* SPECIES**

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**OVERVIEW**

Following field investigations into Northern Territory and the Cape York Region of North Queensland, it became apparent that three different species of *Crinum* were being classified under a single taxon, *Crinum uniflorum* F. Muell., largely upon the basis of confused herbarium studies. The morphology of these three species differed significantly, perhaps better appreciated in the field and in cultivation, and these species also generally occurred in differing habitats.

**INTRODUCTION**

Ferdinand von Mueller (1862-63) described *Crinum uniflorum* from a herbarium specimen (Fig. 1) collected by his assistant, Diedrich Henne, at Sweer's Island located in the Gulf of Carpentaria, Queensland, Australia. Henne made the collection during the Queensland Relief Expedition of 1861-62. The sheet consisted of 4 small, sessile uni-flower scapes, one of which was in bud and one just beginning to form a fruiting body. Apparently either there was more material available from Henne's collection than just the herbarium sheet or Henne provided supplementary

field notes not recorded on the herbarium sheet, because Mueller wrote brief descriptions of the bulb (ovate globe) and the seeds (measuring 3-5 lines = 6.3-10.5mm), neither bulbs nor seeds being included with the herbarium specimen. Mueller made the comment: "Leaves not seen by me", and indeed the herbarium specimen did not contain any leaves. (Note: This is the holotype specimen; the herbarium sheet also contains a determinant slip dated 1985 from the Flora of Australia Project signed by H.J. Hewson, denoting its status as the holotype specimen.)

In a subsequent publication Mueller (1867-68) reported a brief supplementary note on *Crinum uniflorum*: "Ad flumen Liverpool-River producit scapum gracilem, flore aliquoties longiorum; folia 1-1½ (foot) longa, ½-¾ (inch) lata. Crescit etiam ad promontorium Cape York." (Note: Mueller's Liverpool River collection site was located circa 300km east of Darwin in Arnhem Land, Northern Territory, far from the Cape York Peninsula of northeast Queensland.) Mueller did not cite a herbarium specimen or make any other remarks in this brief supplement. However, a survey of Australian herbaria revealed that Mueller did deposit a uni-flower herbarium specimen from the Liverpool River (Fig. 2), containing a single truncated leaf 27cm long x 7mm wide or somewhat smaller than the measurements cited in the description; the specimen determinant slip was signed by Mueller, and in the same handwriting was recorded the identity "*Crinum uniflorum*" and the location "Liverpool-River".

Five years later, George Bentham (1873), assisted by Mueller, compiled a detailed account of *Crinum uniflorum* in Flora Australiensis. The description of the leaves was: "Leaves linear, long and flaccid, scarcely above 2 to 3 lines broad." (Note: A "line" is one twelfth of an inch or approximately 2.1mm.) The first herbarium specimen cited in this account was Coen River (Cape York Peninsula), Gulf of Carpentaria, R. Brown **5640** (Fig. 3), which included appropriate leaves for this description – 5mm wide – and bearing uni-flower scapes displaying short pedicels <1cm long. (Note: Apparently "Coen River" per Brown was actually the Pennefather River, north of Weipa in Cape York Peninsula.) The second specimen cited was Henne's, and then there were 2 additional specimens cited which were collected in the Cape York region by M'Gillieray and Veitch. Mueller's specimen from the Liverpool River was notably absent from the list, perhaps because the corresponding description indicated wider leaves.

The R. Brown **5640** specimen from the Coen River (Pennefather River)



**Fig. 1.** Henne s.n., Sweet's Island, holotype specimen, *Crinum uniflorum* F. Mueller. Photograph courtesy of the National Herbarium of Victoria (MEL), Royal Botanic Gardens Melbourne.



**Fig. 2.** F. Mueller s.n., Liverpool River; Northern Territory, holotype specimen, *Crinum muelleri* Lehmiller & Lykos. Photograph courtesy of The State Herbarium of South Australia (AD).





**Fig. 3.** R. Brown 5640, Coen River (Pennefather River), Cape York, "*Crinum carpentaria*". Photograph © The Natural History Museum (NHM), London. (*Crinum yorkensis* Lehmiller, Lykos & Hamilton)

was originally collected in 1802, deposited in the Banksian Herbarium and later transferred to The Natural History Museum, London. Brown had identified it as “*Crinum carpentaria*” on the herbarium sheet, but he did not publish this finding in his subsequent comprehensive account of Australian flora (R. Brown, 1810). In the latter publication, Brown detailed a *Crinum* Subsection containing three Australian species, two being new species, *Crinum angustifolium* and *Crinum venosum*. Why he overlooked his “*Crinum carpentaria*” in this publication was puzzling – he deposited the herbarium sheet of this plant in his file of *C. angustifolium*. Interestingly, Brown delineated his *Crinum* Subsection under a broader category, Section I: “Root a bulb. Flowers provided with a spathe, umbellate, rarely solitary.” He must have had a limited encounter with his “*Crinum carpentaria*” and therefore declined to publish it as a separate new species.

#### FIELD STUDIES

During a field investigation accomplished in late 2008, Lykos and Lehmiller examined indigenous *Crinum* populations occurring in Northern Territory; partial records of these findings were published in earlier accounts (Lehmiller, 2008; Lehmiller & Lykos, 2009). The expedition commenced in Darwin on November 28, 2008 and concluded on December 5, 2008.

While in the field, a number of flowering populations of “*Crinum uniflorum*” were encountered. However, it became apparent that there were two separate populations of small, sessile uni-flower species, and during the trip, these were informally segregated into a “wide leaf form” (WL) (Fig. 4, 5) and a “narrow leaf form” (NL) (Fig 6, 7, 8). The basic differences between the two were:

- 1) WL bulbs were larger, circa 4.0cm diameter, possessed wider leaves (5-11mm wide) with blunt acute tips, and the leaves arose in an adpressed manner and were nearly planar and nearly distichously arranged.
- 2) NL bulbs were smaller, circa 2.0cm diameter, possessed channeled narrower leaves (1.5-3.5mm wide) with slender-tapering pointed tips, and the non-distichous leaves were so narrow it could not be determined whether or not they exhibited clasping at the base (similar to *Crinum baumii* Harms of Namibia).

These were not two different varieties of the same species; these were two different species. (See Fig. 9 for a visual side-by-side comparison between flowering NL and WL bulbs recorded during the expedition. Figure 10 compares early leaves of the two bulbs in cultivation, while Fig. 12 compares mature leaves in mid season, well past the blooming period. Figure 11 shows a WL bulb in flower.)

We encountered the NL species bulbs more frequently (10 sites) than the WL bulbs (4 sites). The two also occurred in differing habitats:

- 1) WL bulbs at one site followed the path of flowing water associated with a shallow temporary rivulet and the banks or edges of a natural gutter in mildly sloping ground (Fig. 4), while at the other three sites it occurred in open forest in sandy silt soils (Fig. 13).
- 2) NL bulbs inhabited localities prone to accumulate standing water during the rainy season, in essence being shallow seasonally-flooded bogs, usually nearly treeless and often grassy (Fig. 14), with sandy silt to clayish soil – when standing water was present, the small 2cm diameter bulbs easily could be extracted intact with the fingers of one hand, literally plucked from the ground.

Following this November-December 2008 field trip, Lehmiller visited the Australian Tropical Herbarium (ATH) located at James Cook University, Cairns Campus. While there, a specimen labeled “*Crinum uniflorum*” was noted, Gray **08945**, having been collected south of Coen in the Cape York Peninsula (Fig. 15) and being of excellent quality. This bulb appeared much larger than the diminutive NL bulbs observed in Northern Territory, and it had a two-flower umbel; was it the same species collected by R. Brown?

In December 2010, Lykos, Lehmiller and Hamilton conducted a field investigation in Northeast Queensland, primarily focused within the Cape York Peninsula and immediately adjacent area to the south (Hamilton, 2011). On two occasions we again encountered the NL species previously recorded in Northern Territory, this time adjacent to the Peninsular Developmental Road near Rocky Creek and again just south of the Hahn River. The habitat was similar as well: open and grassy seasonally flooded bogs in clayish sandy soil (Fig. 16). At one location, bulbs of *Crinum angustifolium* R. Brown were noted in the periphery of the bog with occasional obvious hybrids between it and the NL species, an occurrence similarly noted on several occasions in Northern Territory (Lehmiller, 2008).

However, when we continued north of the Hahn River and just beyond Healy Creek, we came across the species correlating with Gray's specimen. It occurred within an open forest habitat in well-drained sandy soil, sometimes in the presence of grass trees (*Xanthorrhoea johnsonii*). Between Healy Creek and the cutoff to Port Stewart, we observed 6 different sites harboring this species, all within the same type of habitat, with some of the populations of flowering bulbs numbering in the thousands (Fig. 17, 18) (See also Hamilton, 2011, for additional field photographs.) We informally designated this species as the 'large form' (LF) of "*Crinum uniflorum*". Although most umbels bore 1-2 flowers, 3-flower umbels were sporadically observed and even rare 4-5 flower umbels were seen. Flowers were erect and actinomorphic. Leaves of LF were arranged in a distinct regular rosette, were deeply channeled or U-shaped in cross section, had minutely denticulate margins, and were 9-17mm wide when flattened. Flowers had short pedicels, usually <1cm in length, but occasional longer pedicels were noted, and fruit were often red colored (Fig. 19). (See Fig. 20 of a LF bulb in cultivation to appreciate the deeply channeled or U-shaped leaves in cross section; Fig. 21 from cultivation demonstrates how sometimes the pedicel on the last blooming LF flower of a 3-5 flower umbel can be unusually long; and Fig. 22 shows side-by-side comparison of NL and LF seeds.)

## DISCUSSION

Since the field investigations, there has been ample time to study and to compare the three species and to document in detail their morphologies and growing patterns as well as to compare them to the pertinent herbaria. Each species differs by multiple characters from the other species, and when armed with detailed descriptions, they are easily separated in the field and in herbaria; that is, should there be leaves included with the herbarium specimen. Herein lays the dilemma: The holotype herbarium specimen for *Crinum uniflorum* F. Muell. is void of leaves. So then, to which of the three species does it correlate? The answer has an arbitrary aspect to it, and our reasoning follows:

- 1) Leaves of the NL species are only 1.5-3.5mm wide and resemble grass, whereas the other two species bear much wider leaves, 5-11mm for the WL species and 5-17mm for the LF species. During collection, transportation, unpacking and then the examination by someone other than the collector, the narrow leaves of the NL





**Fig. 4.** (WL) wide leaf bulb with 2 scapes in bud, north of Pine Creek (S13 45.169,E131 44.854), Northern Territory, growing on the edge of a leaf-filled rivulet, December 4, 2008. (*Crinum muelleri* Lehmiller & Lykos)



**Fig. 5.** (WL) wide leaf bulb with early senescence pinkish flower, Daly River Road (S13 30.059, E130 58.969), Northern Territory, December 4, 2008. The 3 early erect leaves with blunt tips stand out from the adjacent grasses. (*Crinum muelleri* Lehmiller & Lykos)





**Fig. 6.** (NL) narrow leaf bulb in bud, Leaning Tree Lagoon (S12 42.574, E131 25.187), Northern Territory, November 30, 2008. The 3 erect leaves at the base of the scape are diminutive compared to the local grasses. (*Crinum uniflorum* F. Muell.)



**Fig. 7.** (NL) narrow leaf bulb in fruit, Berry Springs Turnoff Road (S12 44.190, E130 50.274), Northern Territory, December 5, 2008. (*Crinum uniflorum* F. Muell.)



**Fig. 8.** (NL) narrow leaf bulb in flower; Leaning Tree Lagoon (S12 42.574, E131 25.187), Northern Territory, November 30, 2008. (*Crinum uniflorum* F. Muell.)





**Fig. 9.** (VL) wide leaf bulb (right) from south of Pine Creek (S13 53.173, E131 50.765), Northern Territory, compared to (NL) narrow leaf bulb (left) from north of the Daly River Road turnoff (S13 16.690, E131 07.801), Northern Territory, December 4, 2008. (*Crinum muelleri* Lehmiller & Lykos versus *Crinum uniflorum* F. Muell.)



**Fig. 10.** Cultivated (WL) wide leaf bulb (left) in bud and early leaf, demonstrating adpressed planar leaves at the base with blunt acute tips, versus (NL) narrow leaf bulb (right) in flower, displaying very slender, grass-like leaves. (*Crinum muelleri* Lehmiller & Lykos versus *Crinum uniflorum* F. Muell.)



**Fig. 11.** Cultivated (WL) wide leaf bulb in flower demonstrating near distichous leaves. (*Crinum muelleri* Lehmiller & Lykos)



**Fig. 12.** Cultivated (VL) wide leaf bulb (rear) and (NL) leaf bulb (front) in mid season with fully developed mature leaves. (*Crinum muelleri* Lehmiller & Lykos versus *Crinum uniflorum* F. Muell.)





**Fig. 13.** (WL) wide leaf bulb habitat, open forest, south of Pine Creek (S13 53.175, E131 50.765), Northern Territory, December 4, 2008. (*Crinum muelleri* Lehmillier & Lykos.)



**Fig. 14.** (NL) narrow leaf bulb habitat, open grassy bog (currently dry as it was too early in the rainy season), Berry Springs Turnoff Road (S12 44.190, E130 50.274), Northern Territory, December 5, 2008. (*Crinum uniflorum* F. Muell.)



**Fig. 15.** B. Gray **08945**, 5.5km south of Coen, Cape York Peninsula, holotype specimen, *Crinum yorkensis* Lehmiller, Lykos & Hamilton. Photograph courtesy of the Australian Tropical Herbarium (ATH).





**Fig. 16.** (NL) narrow leaf bulb habitat, open seasonally-flooded grassy-bog, south of Rocky Creek (S15 13.105, E143 54.599), Cape Peninsula Region, December 3, 2010. A flowering scape is peaking through the grass just to the right of center. (*Crinum uniflorum* F. Muell.)



**Fig. 17.** (LF) large form bulb habitat, eucalypt forest, north of Musgrave (S14 15.951, E143 17.873), Cape Peninsula Region, December 4, 2010. (*Crinum yorkensis* Lehmiller, Lykos & Hamilton.)





**Fig. 18.** (LF) large form bulb sporting a 3-flower scape, north of Musgrave (S14 32.704, E143 25.776), Cape Peninsula Region, December 4, 2010. (*Crinum yorkensis* Lehmiller, Lykos & Hamilton.)



**Fig. 19.** (LF) large form bulbs in fruit, often reddish colored, south of the Port Stewart Cutoff (S14 15.951, E143 17.873), Cape Peninsula Region, December 5, 2010. (*Crinum yorkensis* Lehmiller, Lykos & Hamilton.)





**Fig. 20.** Cultivated (LF) large form bulb demonstrating the deeply channeled or U-shaped leaves in cross section, the leaves exhibiting clasping at the base and forming a rosette. (*Crinum yorkensis* Lehmiller, Lykos & Hamilton.)



**Fig. 21.** Cultivated (LF) large form, 3-flower scape post anthesis, demonstrating pedicels, with the last blooming flower (right) exhibiting an usually long pedicel. (*Crinum yorkensis* Lehmiller, Lykos & Hamilton.)



**Fig. 22.** Cultivated (NL) seeds (left) versus (LF) seeds (right). (*Crinum uniflorum* F. Muell. versus *Crinum yorkensis* Lehmiller, Lykos & Hamilton.)

species in the holotype herbarium sheet could easily have become detached and lost or even not appreciated as they were not attached to a bulb, and possibly they could even have been discarded.

Additionally, either bulbs and seeds accompanied the herbarium specimen or supplemental field notes described both the bulbs and seeds – yet no leaves were seen by Mueller and he did not include leaf description/measurements from the supplemental field notes if they existed. A good example of an intact herbarium specimen of this species demonstrating leaves attached to a bulb is Symon **43262** (AD) (Fig. 23).

- 2) The WL species correlates with Mueller's Liverpool River specimen, and yet apparently this specimen and its account was excluded/omitted by Bentham and Mueller in 1873, implying that it did not fit their concept of *C. uniflorum*.
- 3) The LF species from Cape York Peninsula, correlating with R. Brown's **5640** Coen River (Pennefather River) specimen and Gray's **08945** specimen south of Coen, stands apart from the other two species, sporting umbels of 1-5 pedicellate flowers with long scapes, and it does not correlate with Henne's holotype specimen from

Sweer's Island. Therefore, it is our conclusion that our NL bulb is *Crinum uniflorum* F. Mueller, and that the other two species deserve recognition as separate taxa.

Detailed descriptions of all three species follow, including a composite illustration and additional photographs; some photographs already mentioned highlight direct comparisons of these species. Specimens cited other than type specimens are either illustrated in this account, shown as living plants, or exhibit excellent morphology for herbarium specimens. In the descriptions, numerical values included within parentheses represent optimum results during cultivation which may not occur or seldom occur in nature. A table (Table 1.) is also provided, summarizing some of the relevant characters of each species for handy comparison. We have included *Crinum roperensis* Lehmillier & Lykos (2010) from Northern Territory in Table 1., because it is a species with flowering umbels rather similar to the three species described in this paper; but *C. roperensis* is a larger species with wider leaves displaying a small depressed midrib on the undersurface and it should not be confused with the *C. uniflorum* complex.

***Crinum uniflorum* F. Mueller.**

**Holotype: Australia.** Sweer's Island, Gulf of Carpentaria, Queensland. 1861-62, Henne **n.s.** (MEL) (Fig. 1). F. Mueller, Fragmenta Phytographiae Australiae 3:23, 1862-63. (Fig. 27)

**Specimens:** Central Arnhem Highway (circa S13.29, E134.31), Arnhem Land, Northern Territory, April 5, 1973, D.E. Symon, ex hort. **42362** (AD) (Fig. 23); Kakadu Highway (S13 47.771, E131 50.723), NE of Pine Creek, Northern Territory, December 1, 2008, ex. hort. June 7, 2011, Lehmillier & Lykos **1963**, and ex hort. July 7, 2012, Lehmillier & Lykos **1968** (TAMU) (Fig. 24).

**Habitat:** Northern Territory & North Queensland. Shallow open, grassy seasonal bogs, in sandy clay to clayish soils (Fig. 14, 16).

**Description:**

Bulb a small globe, 1.7-2.8cm diameter, covered with a brown tunic containing tiny wooly fibers, with an underground neck 2-6cm long; offsets rare. Leaves 2-6(-11), arising from the ground without a pseudostem and not exhibiting clasping at the base, erect except for older declining leaves, nearly linear but displaying a longitudinal groove or

channel, slowly tapering to a slender point at the tip, margins entire, not containing woolly fibers when torn, shiny green, maximum length 13-36cm, maximum width 1.5-3.5mm. Scape arising from the ground, green with variable reddish pigmentation usually more prominent at the base, ovoid, 7-28cm long. Spathe composed of two slender bracts, 4-5cm long, usually withering or withered at anthesis but tending to still envelop the ovary, greenish sometimes tinged with red. Umbel 1, rarely 2; flower suberect, nearly actinomorphic, white and starry appearing, but turning pink during senescence; sessile; opening at night; lightly scented (best appreciated at night). Buds initially vertical, moving to a vertical drooping state the day prior to anthesis, and then arising and becoming suberect at anthesis. Ovary light green, 8-11mm x 5mm. Perianth tube light green, sometimes with dull reddish pigment at the base, straight but with a distal curve, 7-12.0cm long. Segments narrowly lanceolate, white, unequal with the outer slightly longer and usually wider than the inner, not distally recurved, 5.9-8.3cm long by 1.1-1.6cm wide; apiculate. Filaments mildly spreading and mildly bowed but tending to cluster in the inferior region of the flower, unequal with the inner slightly longer, white proximally and purplish pink distally, 2.5-4.9cm long; anthers mildly curved at anthesis, 10-12mm long; pollen golden yellow. Style white proximally and purplish pink distally, 4.2-6.0cm long; stigma capitate. Fruit globular, developing a somewhat bumpy contour secondary to the enclosed growing seeds, with vague outlines of end-to-end grooves on the surface, light green with some rust red pigment, 1.6 x 1.4 x 1.2cm to 2.0 x 1.8 x 1.6cm, with an apical projection (residual perianth tube) 3.2-6.0cm long. Seeds smooth with compression effects from adjacent seeds, light green, 2-13/fruit, measuring 0.3-1.5cm in maximum dimension.

***Crinum muelleri* Lehmiller & Lykos, *sp. nov.***

***Holotype:* Australia.** Liverpool River, Arnhem Land, Northern Territory, specimen undated, F. Mueller **s.n.** (AD) (Fig. 2). (F. Mueller, *Fragmenta Phytographiae Australiae* 6:251, 1867-68.) (Fig. 27)

***Specimens:*** Stuart Highway (S13 53.175, E131 50.765), south of Pine Creek, Northern Territory, December 4, 2008, ex hort. June 6, 2011, Lehmiller & Lykos **1964** (TAMU), and ex hort. June 13, 2012, Lehmiller & Lykos **1965** (TAMU) (Fig. 25).



**Habitat:** Northern Territory. Adjacent to drainage gutters and small temporary rivulets or within an open eucalypt forest, with sandy silt soils (Fig. 4, 13).

**Description:**

Bulb ovoid to pear shaped, 3.6-4.3cm in diameter to 6.0cm tall, covered with a brown papery tunic, with a tapering underground neck 6.0cm long; offsets rare. Leaves 4-6(-10), arising from the ground without a pseudostem, new leaves adpressed and planar without clasping at the base, suberect with older longer leaves arching and becoming slightly channeled proximally, nearly distichously arranged, strap-shaped with blunt acute tips, margins entire, not containing wooly fibers when torn, shiny dark green, maximum length 18-41cm, maximum width 5-11mm. Scape arising from the ground, dull green with reddish pigment near the base, ovoid, 16-22cm long. Spathe composed of two bracts, 4-5.2cm long, green but becoming pink tinged when withered at anthesis. Umbel 1, rarely 2; flower suberect, nearly actinomorphic, white and starry appearing, but often turning pink during senescence; sessile; opening at night; pleasantly scented. Buds initially vertical, moving to a vertical drooping state the day prior to anthesis, and then arising and becoming suberect at anthesis. Ovary shiny medium green, 9-13mm x 6-7mm. Perianth tube pale green, straight but with a distal curve, 9-12.5cm long. Segments narrowly lanceolate, white, unequal with the outer usually slightly longer and wider than the inner, not distally recurved, 6.3-7.7cm long by 1.1-1.9cm wide; apiculate. Filaments mildly spreading and mildly bowed but tending to cluster in the inferior region of the flower, unequal with the inner slightly longer, white proximally and purplish pink distally, 4.0-4.9cm long; anthers mildly curved at anthesis, 9-10mm long; pollen golden yellow. Style white proximally and purplish pink distally, 6.0-8.0cm long; stigma capitate. Fruit globular, with vague outlines of multiple end-to-end grooves on the surface, light green turning tan near maturity, 2.5 x 2.5 x 2.2cm to 4.0 x 3.5 x 3.5cm, with an apical projection (residual perianth tube) 5.5-6.0cm long. Seeds smooth with compression effects from adjacent seeds, light green, 6-26/fruit, measuring 0.6-1.3cm in maximum dimension.

**Comment:** This species is named in honor of Ferdinand von Mueller who originally discovered this bulb.

***Crinum yorkensis* Lehmiller, Lykos & Hamilton, sp. nov.**

**Holotype:** **Australia.** Peninsular Developmental Road (S14 23.0, E143 20.0), 5.5km south of Coen, Cape York Peninsula, Queensland, December 17, 2004, B. Gray **08945** (ATH, formerly QRS) (Fig. 15). (Fig. 27)

**Specimens:** Coen River (Pennefather River), Cape York Peninsula, 1802, R. Brown **5640** (NHM) (Fig. 3); Peninsular Developmental Road (S14 15.951, E143 17.873), south of Coen, Cape York Peninsula, Queensland, December 4, 2010, ex hort. September 2, 2011, Lehmiller, Lykos & Hamilton **1956** (TAMU) (Fig. 26).

**Habitat:** North Queensland. Open forest, in well-drained sandy soils (Fig. 17, 18).

**Description:**

Bulb ovoid, 3.0-4.1cm in diameter, covered with a brown tunic, with an underground neck 4-6cm long; offsets not seen. Leaves 3-8(-12) arising from the ground without a pseudostem, with new leaves clasped by the adjacent leaf at the base, low arching in a distinct rosette with older leaves laying on the ground, long and slender, deeply channeled or U-shaped in cross section, tapering to a slender acute tip, lacking a depressed offset midrib, margins bearing spaced minute denticulations, wooly fibers not detected when torn, maximum length 31-55(-72)cm, maximum width 9-17mm when flattened. Scape arising from the ground, often dull green distally with variable intense dull-red to rust-red pigment in the basilar region but sometimes entirely rust-red throughout, ovoid, 28-49cm long. Spathe composed of two slender bracts, circa 5.3cm long, withered at anthesis. Umbel 1-3, rarely 4-5; flowers erect, actinomorphic, white but often turning pink during senescence; pedicellate, pedicels usually 5-9mm long, occasionally to 20mm long, and rarely to 32mm long in the last blooming flower of 3-5 flower umbels; opening at night, lightly scented. Buds initially vertical, then moving to nearly a vertical drooping state the day before anthesis, and then arising to an erect position at anthesis. Ovary shiny medium green, sometimes with reddish pigment present, 10mm x 4mm. Perianth tube light green with sometimes reddish pigment proximally, straight – without a distal curve, 7.8-10.5cm long. Segments narrowly lanceolate, white, unequal with the outer slightly longer, mildly distally recurved, 6.5-8.5cm long by 1.1-1.2cm wide, apiculate. Filaments

uniformly spreading in a radial manner and bowed, unequal with the outer slightly longer, white proximally and pinkish purple distally, 3.8-4.2cm long; anthers mildly curved at anthesis, 8mm long; pollen yellow. Style white proximally and pinkish purple distally, 6.5cm long; stigma trilobed capitate. Fruit globular to sometimes trilobed, greenish but often with variable and sometimes diffuse reddish pigment, 3.0 x 2.5 x 2.0cm and smaller, with an apical projection (residual perianth tube) 0.5-4.0cm long. Seeds ovoid or compressed, smooth light green, 3-17/fruit, measuring 0.6-2.1cm in maximum dimension.

#### ACKNOWLEDGEMENTS

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**TABLE 1. COMPARISON OF *CRINUM UNIFLORUM*, *CRINUM MUELLERI*, *CRINUM YORKENSIS* & *CRINUM ROPERENSIS*.**

Morphology	<i>Crinum uniflorum</i>	<i>Crinum muelleri</i>	<i>Crinum yorkensis</i>	<i>Crinum roperensis</i>
Number of flowers	1, rarely 2	1, rarely 2	1-3, rarely 4-5	1-2, seldom 3
Flower morphology	sessile, suberect, nearly actinomorphic	sessile, suberect, nearly actinomorphic	pedicellate, erect, actinomorphic	pedicellate, erect to nearly erect, nearly actinomorphic
Scape length	7-28cm	16-22cm	28-49cm	17-31cm
Bulb diameter	1.7-2.8cm	3.6-4.3cm	3.0-4.1cm	4.0-7.0cm
Leaf width (max.)	1.5-3.5mm	5-11mm	9-17mm	15-28mm
Leaf morphology	very slender & grass-like, erect, channeled, very slender tapering point at tip, margins entire	new leaves adpressed at base, suberect, planar distally & slightly channeled proximally, blunt acute tip, margins entire	new leaves clasped at base, low arching rosette, deeply channeled or U-shaped, slender tapering point at tip, margins minutely denticulate	new leaves clasped at base, low arching rosette, modestly channeled with a small depressed midrib, margins minutely denticulate
Habitat	shallow seasonal bogs, usually open and grassy, sandy clay to clayish soil	open eucalypt forest or along banks of temporary rivulets, sandy silt soil	open forest, sandy soil	scrub brush, reddish sandy soil with clayish subsoil





**Fig. 23.** D.E. Symon, ex hort. **42362**, *Crinum uniflorum* F. Muell., Arnhem Land, Northern Territory, an excellent herbarium specimen with leaves attached to the bulb. Photograph courtesy of The State Herbarium of South Australia (AD).



**Fig. 24.** Lehmillier & Lykos ex hort. 1963, *Crinum uniflorum* F. Muell., Kakadu Highway, Northern Territory, displaying excellent flower morphology and very slender leaves.

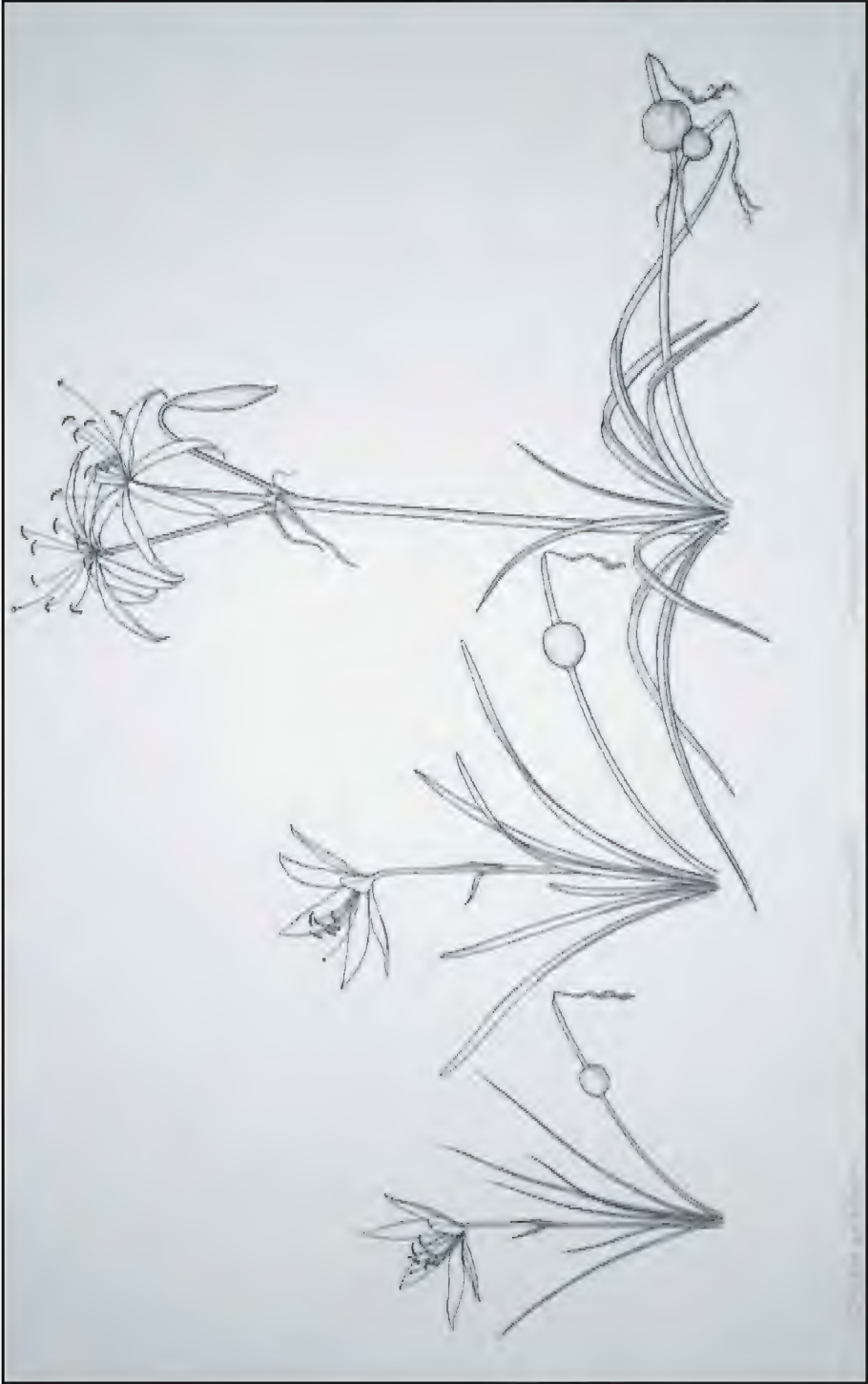


**Fig. 25.** Lehmiller & Lykos ex hort. 1965, *Crinum muelleri* Lehmiller & Lykos, south of Pine Creek, Northern Territory, demonstrating excellent flower morphology and blunt acute tips on the leaves. From the same bulb pictured in Figure 9.



**Fig. 26.** Lehmiller, Lykos & Hamilton ex hort. 1956, *Crinum yorkensis* Lehmiller, Lykos & Hamilton, south of Coen, Cape York Peninsula, demonstrating excellent flower morphology and a slender tapering leaf tip.





**Fig. 27.** Composite illustration (to scale) of the "*Crinum uniflorum* complex" by Kristin Jakob. Left to right: *Crinum uniflorum* F. Muell., *Crinum muelleri* Lehmiller & Lykos, and *Crinum yorkensis* Lehmiller, Lykos & Hamilton.

## NEW *CRINUM* TAXA FROM AUSTRALIA (AMARYLLIDACEAE)

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### OVERVIEW

Our group undertook a series of field investigations on the genus *Crinum* in Australia, either individually, in twos, or in threes during the first decade of the 21<sup>st</sup> Century. We have visited but not thoroughly explored South Australia, Northern Territory, Queensland, and New South Wales. Intermittent accounts of our adventures and findings have been published previously (Hamilton, 2005, 2006-7; Lehmiller, 2008; Hamilton, 2010; Lehmiller & Lykos, 2010; Hamilton, 2011; Lehmiller, Lykos & Hamilton, in press). This report describes a new species and a new variety from Northern Territory and a new species from Queensland which we have not formally described elsewhere.

### A. NORTHERN TERRITORY

In 2008, Lykos and Lehmiller set out to explore north and north-central portions of Northern Territory. As our plane was approaching the Darwin Airport and preparing to land, Lykos observed from his window seat a field where *Crinum* were blooming. Subsequently, we were able to locate this site within the immediate metropolitan area of Darwin, in protected Aboriginal land bordering Dick Ward Road. These bulbs were growing in

low, seasonally wet areas in partially wooded grasslands. Some bulbs were blooming, and some bore scapes in seed (Fig. 1, 2). Our initial impression was that these bulbs were possibly *Crinum angustifolium* R. Brown, except that the leaf margins were entire, not scabrous, a finding which left us puzzled.

Lykos had received a communication from a friend relating that indigenous *Crinum* were to be found near Charles Darwin University, so upon leaving Dick Ward Road, we drove to the periphery of the University Campus. There in lowlands adjacent to the ocean in a protected nature park with walking trails, we found the identical *Crinum* in bloom in seasonally flooded areas, the plants being more numerous and more robust appearing (Fig. 3). Again the leaf margins were entire.

Leaving Darwin and driving south on the Stuart Highway, we soon encountered unequivocal blooming of *Crinum angustifolium* in the flood plain of the Elizabeth River (Fig. 4). Although bearing resemblance to the Darwin *Crinum*, its leaf margins were distinctly scabrous. During the remainder of our trip south and southeast of Darwin, we observed *C. angustifolium* at 24 additional sites; in each case the leaf margins were uniformly scabrous.

After traversing the Arnhem Highway east to Jabiru, during which we had encounters with *C. uniflorum* F. Mueller and *C. angustifolium*, we took the Kakadu Highway to the southwest, passing Nourlangie and heading towards Pine Creek. About midway, we observed a large, depressed shallow bog, very grassy at the moment but clearly a site that would be seasonally inundated when the rainy season fully erupted (Fig. 5). From the highway we could see a few blooming *Crinum* umbels soaring above the local grasses, so we began to explore this site. In the periphery we found a few non-blooming bulbs of *C. uniflorum* where standing water would be shallow, but in the middle region where the blooming bulbs were located, we found an undescribed *Crinum* species. This species had erect actinomorphic flowers, multi-flowered umbels, and its sturdy leaves were deeply channeled (U-shaped in cross section) with scabrous margins, arching and arranged in a rosette pattern (Fig. 6, 7, 8). Plants were approximately the same physical size as *C. flaccidum* Herbert and *C. arenarium* Herbert (syn. *C. brisbanicum* F.M. Bailey), but their leaves were distinctly different in morphology and arrangement. As we were in Kakadu National Park territory, we informally referred to this species as the Kakadu *Crinum*.



**Fig. 1.** *Crinum angustifolium* var. *darwinensis*, Dick Ward Road near Darwin, Northern Territory, November 29, 2008.





**Fig. 2.** *Crinum angustifolium* var. *darwinensis* in fruit, Dick Ward Road near Darwin, Northern Territory, November 29, 2008.



**Fig. 3.** *Crinum angustifolium* var. *darwinensis* flowering umbel, near Charles Darwin University, Darwin, Northern Territory, November 29, 2008. Note the oblanceolate petals.



**Fig. 4.** *Crinum angustifolium* var. *angustifolium*, flood plain of Elizabeth River near Stuart Highway, south of Darwin, Northern Territory, November 29, 2008.



**Fig. 5.** Bog habitat of *Crinum kakaduensis*, Kakadu Highway, Northern Territory, December 1, 2008. A few bulbs are blooming in the central area. Photograph taken from the elevated highway.





**Fig. 6.** *Crinum kakaduensis* in bud, Kakadu Highway, Northern Territory, December 1, 2008. Its arching leaves blend in with the tall grasses.



**Fig. 7.** *Crinum kakaduensis* in flower, Kakadu Highway, Northern Territory, December 1, 2008.





**Fig. 8.** Close up view of *Crinum kakuensis* to display its deeply channeled or U-shape arching leaves, Kakadu Highway, Northern Territory, December 1, 2008.





**Fig. 9.** *Crinum kakaduensis* in a bog habitat near Gregory's Tree, Northern Territory, December 3, 2008. On close scrutiny, the arching leaves of this *Crinum* can be differentiated from the clumps of grasses – at least 20 bulbs are in leaf in this image.

Several days later, when we were traveling southwest of Katherine on the Victoria Highway and had turned off onto the road leading to Gregory's Tree (a large historic Boab tree marked by explorer Angustus Gregory in 1856), we again encountered the Kakadu *Crinum*, this time in a smaller, seasonally flooded bog containing standing water (Fig. 9). Unfortunately due to the time of day, no pristine flowering umbels were available for photography, similar to our encounter along the Kakadu Highway. We also noted a solitary bulb in a seasonal flooded bog area at nearby Timber Creek, but we could not locate any other bulbs when we briefly explored this latter site.

## 1) DISCUSSION

Since the 2008 field trip, there has been ample time to cultivate and to study the Darwin *Crinum* and to compare it to *C. angustifolium*. A denticulate leaf margin versus an entire margin is a major character difference in the separation of *Crinum* taxa; this field observation has been verified in cultivation. Also, in cultivation it is easy to separate the two by leaf arrangement – central leaves of *C. angustifolium* are more erect and high arching when compared to the more spreading and lower arching

leaves of the Darwin *Crinum* (an effect not readily apparent in the field). Other aspects of leaf morphology appear similar, although for similar sized bulbs, leaves of *C. angustifolium* grow much longer than the Darwin *Crinum*, often reaching >90cm in length.

Comparisons of flower buds and floral patterns between *C. angustifolium* and the Darwin *Crinum* are exhibited in Figures 10 and 11. Buds of *C. angustifolium* are slender and display vertical drooping the day prior to anthesis, whereas the stout Darwin *Crinum* buds are deeply inclined but not truly vertical. At anthesis, *C. angustifolium* possesses a radial symmetrical flower (actinomorphic) with narrow lanceolate petals and a straight perianth tube, whereas the Darwin *Crinum* often displays a slight bend in the distal perianth tube and its flowers have oblanceolate petals.

No significant morphological differences are observed regarding bulbs, fruits and seeds between *C. angustifolium* and the Darwin *Crinum*.

We had hoped to pursue DNA analysis to further differentiate the Darwin *Crinum* from *C. angustifolium*, but we have been unable to make satisfactory arrangements as of this date. Until such time, we have elected to pursue variety status for the Darwin *Crinum* primarily upon the basis of smooth (entire) leaf margins versus denticulate leaf margins, although we have not ruled out the possibility of it being an entirely separate species from *C. angustifolium*.

***Crinum angustifolium*** R. Brown. Prod. Flor. 1810, p297.

***Holotype:*** **Australia.** Coen River (Pennefather River), Cape York Peninsula, Queensland; November 6, 1802, R. Brown **s.n.** (NHM).

**1a. *Crinum angustifolium* var. *angustifolium***

**1b. *Crinum angustifolium* var. *darwinensis*** Lehmiller & Lykos, **var. nov.**

***Holotype:*** **Australia.** Near Charles Darwin University, Darwin, Northern Territory, November 29, 2008, ex. hort. July 1, 2011, Lehmiller & Lykos **1960** (TAMU). (Fig. 12)

***Habitat:*** Low, seasonally inundated areas in the immediate Darwin region.

***Description:***

Bulb globular, covered with a thin dark brown tunic, 5.0-9.0cm in diameter, with a short underground neck 2-4cm long. Leaves 8-14,



**Fig. 10.** *Crinum angustifolium* var. *darwinensis* (left) with plump, deeply inclining buds, versus *C. angustifolium* var. *angustifolium* (right) with slender, vertical drooping buds.



**Fig. 11.** *Crinum angustifolium* var. *darwinensis* (left) flowers with oblanate petals and showing slight bending of the distal perianth tube, versus *C. angustifolium* var. *angustifolium* (right) flowers with narrow lanceolate petals and displaying straight perianth tubes. (Same umbels as Fig. 10)





**Fig. 12.** Holotype specimen for *Crinum angustifolium* var. *darwinensis*, Lehmillier & Lykos **1960**, near Charles Darwin University, Darwin, Northern Territory, ex hort. July 1, 2011 (TAMU).



arising from the ground without a pseudostem, suberect and spreading, forming a rosette, channeled with midline thickening but lacking a distinct depressed midrib effect, strap shaped and tapering to a blunt acute tip, with fold creases evident distally near the tip region, green, margins entire, containing tiny wooly fibers when torn apart, maximum length 43-60cm, maximum width 5.8-9.3cm. Scape arising from within the leaves, dull green with reddish pigment sometimes near the base, 45-74cm long. Spathe composed of 2 principal bracts, erect and spreading but beginning to wither at anthesis. Umbel 6-21; flowers nearly erect to suberect, nearly actinomorphic, white; pedicellate, with pedicels measuring 1.5-2.5cm long; opening at night; scent faint to non-existent. Buds initially erect, somewhat plump appearing, then moving to a deeply inclined but not vertical position the day prior to anthesis, before moving to a suberect to nearly erect position at anthesis. Ovary shiny dark green, about 10 x 6mm. Perianth tube green, sometimes straight but often with a slight distal bend, 10.0-12.5cm long. Segments oblanceolate, white, unequal with the outer usually slightly longer, 5.8-7.8cm long, 1.2-2.1cm wide, not distally recurved; apiculate. Filaments spreading and mildly bowed, white proximally and pinkish purple distally, 3.4-4.7cm long. Anthers dark; pollen golden yellow. Style light pink proximal to dark pinkish purple distally, 3.2-5.7cm long; stigma capitate, tri-lobed. Fruit globular, often with 3 grooves giving it a trilobed shape, green, 5.5 x 4.3 x 4.0cm to 3.5 x 3.2 x 2.2cm; with an apical projection (residual perianth tube) 5.5-8.0cm long. Seeds smooth with compression effects from adjacent seeds if numerous, light green, 3-21/fruit, measuring 1.2-2.5cm in maximum dimensions.

## 2) DISCUSSION

The unique features of the Kakadu *Crinum* are its (1) leaf construction and (2) leaf arrangement:

- 1) Leaves are sturdy, deeply channeled or U-shaped in cross section, and possess denticulate margins (Fig. 7, 13). No other Australian species has sturdy U-shaped leaves in cross section. *Crinum yorkensis* Lehmiller, Lykos & Hamilton (in press) has U-shaped leaves in cross section but they are not sturdy; it is a much smaller species though which excludes it from the differential diagnosis.

- 2) Leaves arise from the ground without a pseudoneck, and when well developed form a distinct regular rosette at ground level (Fig. 13).

The flowers of the Kakadu *Crinum* are strictly actinomorphic (radially symmetric) with the perianth tubes always straight (Fig. 14). Two other Australian species of similar stature with actinomorphic flowers and straight perianth tubes are *C. arenarium* and *C. angustifolium*. The former has leaves (and bulbs) similar to *C. flaccidum*, being channeled but neither U-shaped in cross section nor sturdy, and its long leaves do not form a classic rosette. *Crinum angustifolium* has channeled sturdy leaves but they are not U-shaped in cross section; it is a larger species with much broader leaves usually >6cm wide and larger umbels to 20 flowers. Both *C. angustifolium* and *C. arenarium* possess globular/spherical bulbs with underground necks (Fig. 15), which are quite different in shape from the conical shaped bulbs of the Kakadu *Crinum* (Fig. 16). (*Crinum pedunculatum* R. Brown is not considered in the differential diagnosis because of its huge size and long above-ground pseudoneck.)

Fruit and seeds of the Kakadu *Crinum* are displayed in Figures 17 and 18.

***Crinum kakaduensis* Lehmiller & Lykos, sp. nov.**

**Holotype: Australia.** Kakadu Highway, southwest of Jabiru, Northern Territory. (S13 18.413, E132 20.207) Originally collected December 1, 2008, ex hort. July 15, 2011, Lehmiller & Lykos **1958** (TAMU). (Fig. 19, 20)

**Specimen:** Road to Gregory's Tree, near Timber Creek, Northern Territory. (S15 34.580, E130 21.682) Originally collected December 3, 2008, ex hort. June 30, 2011, Lehmiller & Lykos **1961** (TAMU).

**Habitat:** Open, grassy, seasonally flooded bogs, in clayish soils.

**Description:**

Bulb conical shaped and tapering into an underground neck, covered with a brown tunic, 4.5-6.0+cm diameter x 11-16cm long. Leaves 6-12(-15), arising at ground level without a pseudostem, sturdy, suberect, distinctly arching and forming a classical rosette, deeply channeled or U-shaped in cross section, lacking a depressed midrib effect, long and slender and slowly tapering to a pointed tip, longitudinal parallel ridges faintly visible on both surfaces, green, margins denticulate, containing thin wooly fibers when torn apart, maximum length 69-101cm, maximum width 1.7-

3.5cm. Scape arising from the ground, ovoid and mildly compressed, light dull green often with dull reddish pigment near the base, 31-48cm long. Spathe composed of 2 principal bracts 6.8-8.7cm long, with a few small filamentous bracts sometimes present, spreading and beginning to wither or completely withered at anthesis. Umbel 3-12; flowers erect to nearly erect, actinomorphic, white; pedicellate, with pedicels 0.5-2.5cm long; opening at night; light pleasant scent. Buds initially erect, often tinged with reddish pigment, then moving to a vertical drooping position the day prior to anthesis, before moving to an erect or nearly erect position at anthesis. Ovary shiny chartreuse green, 1.4cm long by 0.8cm diameter. Perianth tube light green, sometimes with variable amounts of dull reddish pigment in the proximal region, straight at anthesis, 6.0-9.5cm long. Segments lanceolate, white, with the outer usually slightly longer, reflexed at the throat and mildly bowed, 5.2-7.9cm long by 0.9-1.5cm wide; apiculate. Filaments inserted at the base of the petal, uniformly spreading and bowed, proximally white and distally pinkish purple, 3.2-5.1cm long; anthers mildly curved, black at maturity, 1.0cm long; pollen golden yellow. Style white at the throat, pinkish purple distally, 5.5-6.8cm long; stigma small capitate. Fruit globular with a slight 3 lobed effect, light green turning pale yellow at maturity, 4.5 x 4.3 x 3.5cm to 3.3 x 2.5 x 3.0cm, with an apical projection (residual perianth tube) 4.5-5.5cm long. Seeds smooth, sometimes marked with a few shallow ridges, somewhat ovoid, medium green, 2-4/fruit, measuring 2.3-2.8cm in diameter.

## B. QUEENSLAND

In an earlier account of a 2010 field trip to the Cape York Region by Lykos, Lehmillier & Hamilton (Hamilton, 2011), mention was made about discovering a new *Crinum* species in Lakefield National Park; field photographs accompanied this account. (Additional field photographs are exhibited in Figures 21, 22, 23.) In the same general region, we also found *C. angustifolium* which made for immediate direct comparisons between the two species, each with umbels of white actinomorphic flowers. The Lakefield species was noticeably a much smaller plant with fewer leaves and smaller umbels than *C. angustifolium*, and it possessed suberect, non-arching channeled leaves with a depressed midrib effect and which were arranged in nearly a distichous pattern. Leaves of *C. angustifolium* did not exhibit a depressed midrib effect, and its leaves were arranged in a rosette pattern.



**Fig. 13.** Bulbs of *Crinum kakuensis* in cultivation. The leaves arise from the ground, form a classic rosette and are deeply channeled (U-shaped) in cross section.



**Fig. 14.** *Crinum kakuensis* flowering in cultivation.





**Fig. 15.** Early blooming size bulbs of *Crinum angustifolium* var. *angustifolium* in cultivation, originally from Leaning Tree Lagoon (left) and flood plains of the Elizabeth River (right), Northern Territory. Note the globular/spherical shape of the bulbs.



**Fig. 16.** Bulbs of *Crinum kakaduensis* in cultivation, originally from Kakadu Highway, Northern Territory. Note the conical shape of the bulbs.



**Fig. 17.** Fruit of *Crinum kakuensis* in cultivation.



**Fig. 18.** Seeds of *Crinum kakuensis* in cultivation.



**Fig. 19.** Holotype specimen for *Crinum kakaduensis*, Lehmillier & Lykos 1958, Kakadu Highway, Northern Territory, ex hort. July 15, 2011 (TAMU).



**Fig. 20.** Illustration of *Crinum kakaduensis* Lehmillier & Lykos by Kristin Jakob.





## DISCUSSION

The Lakefield *Crinum* is a small stature plant with normally 5-6 suberect non-arching leaves which measure <40cm long and <3cm wide. One would not find a blooming size bulb of *C. angustifolium* that would fall into this realm – the latter is a much larger species with larger umbels and with leaves often >60cm long and >6cm wide. There should be no confusion between these two species in the field or in herbaria.

The species which closely approximates the Lakefield *Crinum* in size is *C. roperensis* Lehmiller & Lykos (2010) from Northern Territory, and leaves of both species exhibit a small depressed midrib effect, unlike other Australian *Crinum* (except *C. pedunculatum* which does not enter into the differential diagnosis). In differentiating these two species, the following comparisons should facilitate the proper identity, especially in the field:

- 1) Umbels of the Lakefield *Crinum* range from 2-8 flowers, with the most common umbels bearing 3-6 flowers. Conversely, *C. roperensis* has umbels of 1-3 flowers, the majority being uni-flower, with occasional bi-flower umbels and uncommon tri-flower umbels. Flowers in multi-flower umbels of *C. roperensis* bloom singly - one at a time; in the Lakefield *Crinum*, 2-3-4-5 flowers in multi-flower umbels will bloom simultaneously on the first day.
- 2) Flowers of the Lakefield *Crinum* are strictly actinomorphic with straight perianth tubes. In *C. roperensis*, flowers are nearly actinomorphic with often a small bend in the distal perianth tube, the bend becoming more apparent during floral senescence.
- 3) Leaves of the Lakefield *Crinum* are suberect, non-arching, held off the ground and nearly distichous in arrangement, whereas leaves of *C. roperensis* are low arching, often in contact with the ground and arranged in a rosette.
- 4) The habitat for the Lakefield *Crinum* is low, open grassy areas prone to become inundated with standing water during the rainy season, with heavy clayish soil. *Crinum roperensis* occurs in open, sparsely wooded, flat scrub brush terrain, with reddish sandy soils and clayish subsoil.

***Crinum lakefieldensis* Lehmiller, Lykos & Hamilton, sp. nov.**

***Holotype:* Australia.** Near the Catfish Waterhole, north of New Laura,

Lakefield National Park, Queensland. (S15 03.826, E144 17.061)

Originally collected December 6, 2010, ex hort. July 12, 2011, Lehmiller, Lykos & Hamilton **1959** (TAMU). (Fig. 24, 25)

*Habitat*: Low, open grassy areas inundated during the rainy season, in clayish soil.

*Description*:

Bulb a flattened globe, covered with a brown, somewhat fibrous tunic, 3.5-4.5cm in diameter, with an underground neck 4.0-5.0cm long. Leaves 3-6, arising from the ground without a pseudostem, sturdy, suberect, non-arching, nearly distichously arranged, channeled with a small depressed midrib effect, lanceolate, tapering to a blunt tip with fold grooves adjacent to the midrib near the tip, green but sometimes with red pigment confined to the dorsal base, margins denticulate, containing tiny wooly fibers when torn across, maximum length 28.5-36.0cm, maximum width 1.9-2.1cm. Scape arising from the ground, mildly compressed, green or dull tan or with variable amounts of reddish pigment usually in the proximal region, 29.0-37.0cm long. Spathe composed of 2 principal bracts about 4.5cm long, sometimes with a few filamentous bracts present, green, withered at anthesis. Umbel 2-8; flowers erect to nearly erect, actinomorphic, white; subsessile to short pedicels up to 1.5cm long; opening at night; lightly scented. Buds initially erect, then moving to a vertical drooping position the day prior to anthesis, before moving to an erect or nearly erect position at anthesis. Ovary shiny green, 0.8-1.3cm long by 0.5-0.6cm diameter. Perianth tube light green to tan, straight at anthesis, 9.0-10.0cm long. Segments narrowly lanceolate, white, reflexed at the throat, 5.9-7.0cm long by 1.0-1.2cm wide; apiculate, more so on the outer segments. Filaments uniformly spreading and bowed, white proximally and dark pinkish purple distally, 4.3-5.5cm long; anthers curved at anthesis and dark/black; pollen golden yellow. Style white only at the throat, dark pinkish purple otherwise, 5.5-6.0cm long; stigma small capitate. Fruit globular with an apical projection about 4cm long. Seeds, green, smooth. (Data limited on fruit and seeds.)

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Botanical artist and IBS Member Kristin Jakob of Mill Valley, California, is acknowledged for the illustrations.

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**Fig. 21.** *Crinum lakefieldensis* in bloom, south of New Laura, Lakefield National Park, Queensland, December 6, 2010. Note the actinomorphic flowers and suberect leaves, the latter held well off the ground.



**Fig. 22.** *Crinum lakefieldensis* demonstrating nearly distichous leaves, south of New Laura, Lakefield National Park, Queensland, December 6, 2010.

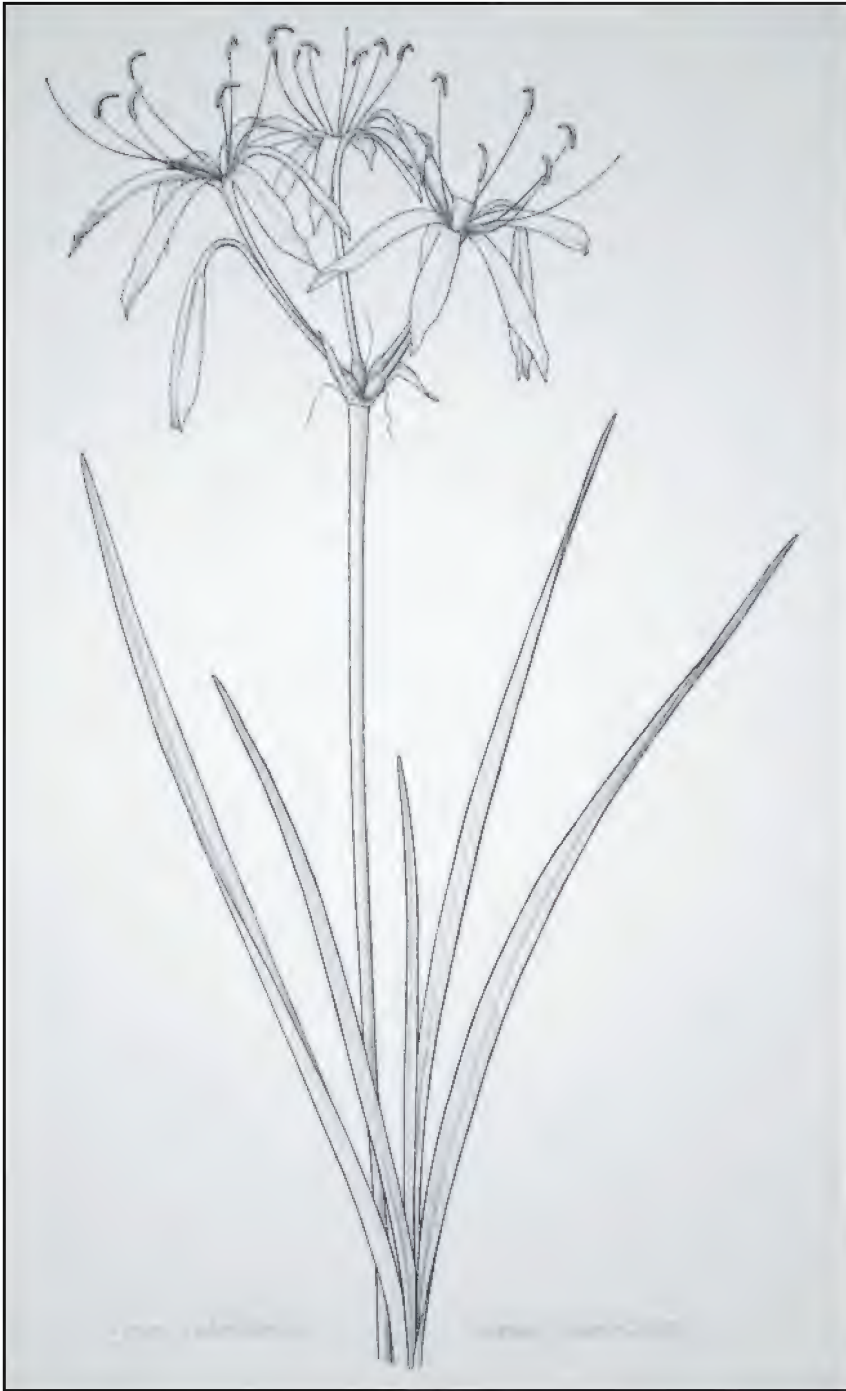




**Fig. 23.** *Crinum lakefieldensis* bearing a large umbel, south of New Laura, Lakefield National Park, Queensland, December 6, 2010. Note the small flattened globular-shaped bulb.



**Fig. 24.** Holotype specimen for *Crinum lakefieldensis*, north of New Laura, Lehmillier, Lykos & Hamilton 1959, Lakefield National Park, Queensland, ex hort. July 12, 2011 (TAMU).



**Fig. 25.** Illustration of *Crinum lakefieldensis* Lehmillier, Lykos & Hamilton by Kristin Jakob.



## ***ALBUCA DEACONII* (HYACINTHACEAE), A NEW BULBOUS SPECIES FROM THE EASTERN CAPE**

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*Albuca deaconii*, a cremnophilous species from the Eastern Cape, is named. This species is at once recognised by its drooping, long-leek-like pendent leaves and its spreading to pendent inflorescence with yellowish green flowers.

### **ALBUCA REDEFINED**

The Ornithogaloid genera to which *Albuca* belongs were recently revised by Manning *et al.* (2009) using molecular data (plastid DNA sequencing). *Albuca* was subsequently redefined to include the subgenera *Osmyne* and *Urophyllon* of the genus *Ornithogalum*. *Albuca* can now be readily recognised by its succulent-textured oblong tepals bearing a dark green to brownish longitudinal band on its adaxial surface (Manning *et al.*, 2009). *Albuca* was established by Linnaeus in his second edition of *Species Plantarum* in 1762, presently consisting of more than a 100 species (Manning & Condry, 2011).

*Albuca deaconii* belongs to the subgenus *Albuca* (Müller-Doblies 1995), which is immediately recognised by the succulent hinged inner tepals and ascending flowers. The outer stamens are usually reduced, whilst the inner are larger and fertile.

### **DISTRIBUTION OF ALBUCA**

*Albuca* has a wide, mainly African distribution which extends into Arabia. Although widely distributed, most taxa are confined to South Africa, especially the southern parts (W. & E. Cape). In South Africa there is a clear centre of endemism in the summer-dry Succulent Karoo and Fynbos biomes. In these parts, *Albuca* is mostly summer deciduous, but some species are evergreen (in the eastern parts where rainfall is in summer



and winter). *Albuca* is also well represented in the Grassland and Thicket vegetation, and its habitat varies from flat to mountainous parts. *Albuca* varies from the very small, *A. unifoliatum* with a solitary succulent leaf only a few cm high to large robust plants such as *A. nelsonii* with leaves up to 60cm high. *Albuca clanwilliamigloria* U. Müll.-Doblies from the W. Cape has an inflorescence 2m and taller!

#### ALBUCA AND CLIFFS

Of the southern Africa species there are 9 *Albuca* species confined to cliff faces or grow on steep slopes. These include *Albuca batteniana* Hilliard & B.L. Burt., *A. cremnophila* Van Jaarsv., *A. crudenii* Archibald, *A. fastigiata* Dryand, *A. kirstenii* Manning, *A. lebaensis* (Van Jaarsv.) Manning & Goldblatt, *A. shawii* Baker, *A. tenuifolia* Baker, and *A. thermarum* Van Jaarsv. & A.E. van Wyk. *Albuca fastigiata*, *A. tenuifolia*, and *A. shawii* are widespread in the summer rainfall regions (grassland & savannah) but not always confined to cliffs, the first named with white flowers and the latter two with narrow linear leaves and yellow flowers (Martinez-Azorin et al., 2011). The remaining species have a more restricted distribution. *Albuca thermarum* is confined to Badspoort (firm leaves bearing yellowish flowers) near Calitzdorp (Succulent Karoo), *A. crudenii* (Albany Thicket species) from Grahamstown bearing a solitary soft flaccid leaf (rarely two) and yellow flowers, *A. kirstenii* is confined to shale cliffs of the Gourtiz and Breede Rivers (Albany Thicket), *A. batteniana* is confined to the dry river valleys (Valley Bushveld) between the Kei to Bashee Rivers, and *A. deaconii* to the Groot Winterhoek of the southeastern Drakensberg. *Albuca lebaensis* grows on cliffs, confined to the escarpment margin in southwestern Angola recently named in the same journal (Van Jaarsveld, 2010). Although named as an *Ornithogalum* (following Obermeyer 1978), Manning & Goldblatt transferred it to *Albuca* (Manning & Goldblatt 2011).

#### *Albuca deaconii* Van Jaarsv., **sp nov.**

*Albuca deaconii* Van Jaarsv. *ab* *A. thermarum*, bulbis 100-120 x 60-80 metentibus, ovoideis, maioribus, foliis fusco cinereo-viridibus, flaccidis, 530-1130 x 30-40mm, et inflorescentiis pendentibus, 320-850mm longis discedit.

#### Type:

**South Africa.** 3226 (Hackney): Fountainhead Farm, upper west facing sandstone cliff, 1400m, (–BC), Deacon **1336** (NBG, holo.).



**Fig. 1.** *Albuca deaconii*, illustration of the type plant by Jeanette Loedolff.



**Fig. 2.** *Albuca deaconii* in habitat, growing with *Euphorbia pulvinata*, *Ornithogalum juncifolium*, and *Rhus* sp. (Photograph by James Deacon)



**Fig. 3.** *Albuca deaconii* in habitat, growing on a sandstone cliff face together with *Crassula ericoides*, *C. pellucida* and the fern *Asplenium cordatum*. (Photograph by James Deacon)





**Fig. 4.** Close up of the inflorescence of *Albuca deaconii*.

### Description:

Evergreen epigeous (rarely hypogeous) bulbous plants, solitary or dividing forming small clusters with up to 5 heads. Bulb ovoid 100-120 × 60-80mm; basal plate 50 × 40mm, tapering to 25mm; tunics fleshy, green, imbricate, withering and becoming grey, the leaf remnants persistent. Roots fleshy, white, to 1mm in diameter. Leaves 530-1130 × 30-40mm, in an apical rosette, firm and leathery, oblong, canaliculate, linear-attenuate, drooping, succulent, grey-green (like a leek), glabrous; becoming almost terete at apex and with an obtuse yellowish end. Inflorescence spreading 320-850mm long soon becoming pendent; the peduncle 10mm in diameter at the base; raceme 130-170mm long; bracts triangular acuminate, clasping pedicles, membranaceous, white, translucent, bearing brownish striations; lower bracts to 42 × 17mm, gradually becoming smaller upwards; pedicles ascending 55-85mm long, becoming smaller upwards (30mm). Flowers 30mm long, erect, yellowish green. Outer tepals linear-obovate 30 × 10mm; yellow with green median portion, faintly striated, the apex hooded; inner tepals 25 × 14mm ovate with a fleshy yellow hinged apical appendage. Filaments white, translucent tapering; outer 16mm in length, 4mm diameter at the base with a constriction in lower third; inner 15mm long and 2.5mm in diameter at base; anthers of inner filaments 6 × 2mm,



the outer  $4 \times 1$  mm. Ovary green, stipitate for 1 mm, 10 mm long, 4.5 mm in diameter – angular; style yellow, linear trigonous  $11 \times 3$  mm; stigma green, tri-lobate. Capsule oblong  $18 \times 9$  mm.

Habitat:

*Albuca deaconii* appears to be an obligatory cremnophyte with drooping to spreading rosettes (solitary or dividing and forming clusters of up to 3 rosettes) of long channelled pendent leathery leaves. Plants grow in mineral poor sandstone cliffs of the southern Drakensberg. According to James Deacon it is never common and mainly confined to cliffs varying from shady to exposed west facing slopes in grassland. Associated species includes *Euphorbia pulvinata* (Fig. 2), *Crassula ericoides*, *C. pellucida* subsp. *marginata*, *Ornithogalum juncifolium* and the fern, *Asplenium cordatum*. The climate in its habitat is warm temperate, with snow and frost during winters. Temperatures are mild during summer (an average daily maximum of 24–27°C. Rainfall is mainly during summer, however also with some during the winter and ranging between 700–1000 mm (thunder showers & cyclonic winter rain).

*Albuca deaconii* flowers mainly during late spring (October and November). The seed are normally released towards the end of November to early December and wind dispersed.

Cultivation:

*Albuca deaconii* is easily grown in containers and can be propagated by division. Most *Albuca* taxa are easily grown from seed sown in a sandy mixture and placed in a warm protected environment.

The cremnophilous *Albuca* species are grown at Kirstenbosch National Botanical Garden, some which can be seen in hanging baskets and containers in the Botanical Society Conservatory and Visitor Centre.

*Albuca deaconii* is a slow grower.

Related species:

*Albuca deaconii* is related to *A. batteniana*, *A. cremnophila* and *A. thermarum*, all evergreen and bearing pendent leaves and belonging to subgenus *Albuca*. From *A. batteniana* and *A. cremnophila* it can be distinguished by its persistent dry leaf bases and grey-green leek-like (*Allium porrum*) leaves and yellowish flowers which are not secundly arranged. *Albuca cremnophila* and *A. batteniana* have erect secundly arranged white flowers. The tepal tips of *A. cremnophila* are also yellowish. Our new species is perhaps closest related to *A. thermarum*, both with

persistent leaf bases and flowers which are not secundly arranged; however the latter having green leaves, longer pedicles and slightly shorter flowers.

### Etymology:

I have pleasure in naming this species after James Deacon, horticultural student at Kirstenbosch for the past 5 years, who assisted the author with caring and help in collecting many of the cremnophytes in the succulent nursery. James is a keen plant explorer and has a sharp eye, especially for the smaller cliff dwelling bulbous plants. He discovered this interesting new species on January 11, 2011 on west facing cliffs on his uncle's (Nigel Brunette) farm, Fountainhead in the Winterberg District. The vegetation consisted mainly of Amatole Mountain Grassland (Mucina, 2006) but plants according to James also grew in patches of Afrotemperate Forest, but always on cliffs.

### ACKNOWLEDGEMENTS

Mr. John Lavranos is thanked for translating the Latin diagnoses. I am grateful to Jeanette Loedolff for the beautiful illustration and to Hester Steyn for preparing the distribution map. James Deacon is thanked for bringing this species to my attention.

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**Fig. 5.** The young inflorescence appearing with protective bracts.



**Fig. 6.** The distribution of *Albuca deaconii* in the Eastern Cape.

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## A NEW *CRINUM* TAXON FROM MADAGASCAR (AMARYLLIDACEAE)

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### INTRODUCTION

When relocating *Crinum* species from the Southern Hemisphere into cultivation in the Northern Hemisphere, it is usually possible through dry dormancy to re-set the biological clocks of the bulbs such that they begin to flower in the spring/summer time rather than the fall/winter time. With seeds the transition is not problematic, but with mature bulbs, this can at times be impossible, making it difficult to adequately study morphological details and flowering cycles. *Crinum xerophilum* (Perrier) ex Lehmillier (2001) is such an example in the author's experience. In such cases, investigators need to make allowances and to anticipate that flowering and dormancy will be out of synchrony with the growing season, being careful to provide adequate environmental modifications if possible.

This account describes a new *Crinum* taxon from Madagascar which has refused to adapt to the Northern Hemisphere growing seasons.

### LOCATION 57

In September 2004, Olaf Pronk from Antananarivo, Madagascar, sent the author 5 mature *Crinum* bulbs to identify, these bulbs having been discovered in April 2004 by one of his collectors at 'Location 57' (Fig. 1). No other information was provided at the time, as the location book containing the collection data had been misplaced. Initially when the bulbs began to grow, their blue-green leaves suggested that they might be *Crinum modestum* Baker, although bulbs lacked the black tunics and underground necks characteristic of the latter species; later the leaves developed a low lateral spreading pattern, also not in accordance with the higher arching leaves of *C. modestum*. In addition, the leaves displayed a narrow reddish band along their margins (Fig. 2), somewhat akin to *Ammocharis angolensis* (Baker) Milne-Redh. & Schweick. (Duncan, 2011). However, the bulbs were received late in the growing season and soon were treated to dry dormancy

over winter. In 2005, the bulbs leafed out in the spring and by late summer they had gone completely dormant without blooming. The same pattern repeated itself in 2006, 2007, and 2008 with no bulbs blooming.

In 2009, the bulbs again leafed out in the spring, appeared healthy, and again by late summer they had gone completely dormant. But then in late September, a bulb bloomed without leaves – it was an undescribed species with actinomorphic flowers, very long perianth tubes and petals with green bands on their dorsal keels (Fig. 3, 4). Not expecting any other bulbs to bloom, the scape was sacrificed to make a herbarium specimen for a holotype (Fig. 5). However, in mid October a second bulb sent up a scape, but it proved to be self incompatible on self pollination. At this juncture, a communication was sent to Pronk inquiring further about ‘Location 57’. He responded that the collection data book had been found, and that ‘Location 57’ corresponded to 12km past Mampikony on the road to Boriziny (Port Bergé) in the Sofia Region of northwest Madagascar ... reputedly one of the warmest localities in Madagascar. No additional details concerning the habitat were available.

No bulbs bloomed in 2010. In 2011, the second bulb bloomed again in mid September, this time in conjunction with the leaves which were declining but the bulb had not yet gone entirely dormant. By then, it was becoming clear that the bulbs were not going to adapt adequately to the Northern Hemisphere growing cycle. In 2012, the bulbs were watered sparingly beginning in mid summer and all but two went completely dormant before the end of August, the remaining two bulbs retaining declining leaves that were no longer exhibiting any active growth. Then a very heavy rainstorm occurred in mid September, and 3 bulbs subsequently bloomed in late September; the two bulbs with leaves both bloomed (Fig. 6, 7) and one bulb without leaves bloomed.

The three blooming bulbs were cross pollinated and abundant seeds were produced. Interestingly, the fruit which developed on the scapes from the bulbs which had retained their leaves only exhibited very short apical projections (residual perianth tubes or beaks) on otherwise apparent normal sized fruit, whereas the fruit on the scape from the bulb without leaves displayed long apical projections (Fig. 8, 9, 10). This finding suggested that the physiology of the latter bulb was in a more favorable state for blooming than the other two bulbs which had not yet entirely shed their leaves.

## DISCUSSION

Only one other Malagasy species bears pedicellate flowers, *C. xerophilum*, a species endemic to the semi-arid region of far southwest Madagascar (Atsimo-Andrefana Region) where the spiny forest (dry forest) resides and where average annual rainfall approximates 400mm per year. In contrast, the Location 57 *Crinum* (L-57 *Crinum*) occurs in far northwest Madagascar circa 800km distant, a region characterized by high annual rainfall circa 1500mm and by high average daily temperatures throughout the year. The rainfall at both regions is typically biphasic with a rainy season and a dry season.

It is assumed that the L-57 *Crinum* is affiliated to *C. xerophilum* because they share similar morphologic features in addition to pedicellate flowers, these being: actinomorphic flowers, lateral spreading and broadly channeled leaves with ciliate margins, similar fruit and seeds, and they overlap in umbel and plant sizes. The major character differences between the two species are: 1) Bulbs of the L-57 *Crinum* are pear shaped with short to non-existent underground necks (Fig. 1) whereas bulbs of *C. xerophilum* are ovoid to oblong with long underground necks (Fig. 11) ; 2) The L-57 *Crinum* has bluish green leaves compared to dark green leaves for *C. xerophilum*; 3) The L-57 *Crinum* leaves have a red border on their margins which *C. xerophilum* leaves lack; 4) Flowers of the L-57 *Crinum* are scentless whereas flowers of *C. xerophilum* emit an unpleasant putrid scent; and 5) Perianth tubes of the L-57 *Crinum* are usually >18cm, sometimes reaching 24cm in length, whereas perianth tubes of *C. xerophilum* are <18cm long, usually <16cm long. Color differences in the flowering parts are evident on direct comparison but are not felt to be significant character differences.

The L-57 *Crinum* possesses the longest perianth tubes (24cm) the author has observed in his 25+ year experiences in cultivating and studying the genus *Crinum* – the previous longest perianth tube was 21cm once observed in a bulb of *C. hildebrandtii* Vatke in Madagascar. The exceptionally long perianth tubes plus the very unusual reddish border of the leaf margins makes the L-57 *Crinum* a unique plant. It is affiliated to *C. xerophilum* but is geographically separated from it, occurs in a different climate, differs by a number of features/characters, and it deserves separate speciation.



**Fig. 1.** Two mature bulbs of *Crinum rubromarginatum* as received from Location 57 in late September, 2004.



**Fig. 2.** Early leaf growth following dormancy of *Crinum rubromarginatum*, the leaves displaying prominent reddish bands that highlight the ciliated leaf margins.





**Fig. 3.** Initial flowering of *Crinum rubromarginatum* (Lehmiller 1969) on September 25, 2009.



**Fig. 4.** Same inflorescence as Figure 3. Note the greenish bands on the dorsal petal keels.



CRINUM RUBROMARGINATUM LEHMILLER  
MADAGASCAR, SOFIA REGION,  
2 KM NORTH OF MAMPIMONY ON THE  
ROAD TO BORIZINY (PORT BERGÉ).  
ORIGINALY COLLECTED APRIL 2004.  
EX HORT. SEPTEMBER 25, 2009.  
LEHMILLER #1969

**Fig. 5.** Type specimen of *Crinum rubromarginatum*, Lehmillier 1969, September 25, 2009 (TAMU).



**Fig. 6.** Bulb of *Crinum rubromarginatum* in active leaf growth, photograph taken on July 24, 2012.



**Fig. 7.** Bulb of *Crinum rubromarginatum* in bloom with declining leaves, photograph taken September 24, 2012. Compare to Figure 6 (same bulb) where the leaves are in an active growing phase.





**Fig. 8.** Fruit on scape of *Crinum rubromarginatum* bulb that flowered with declining leaves present, October 19, 2012. Note the very short residual perianth tubes.



**Fig. 9.** Fruit on scape of *Crinum rubromarginatum* bulb that flowered in the absence of leaves, October 19, 2012. Note the long residual perianth tubes.





**Fig. 10.** Seeds of *Crinum rubromarginatum*.

***Crinum rubromarginatum* Lehmiller, sp. nov.**

**Holotype:** Madagascar. 12km north of Mampikony on the road to Boriziny (Port Bergé), Sofia Region, April 2004; ex hort. September 25, 2009, Lehmiller 1969 (TAMU). (Fig. 2, 5, 12)

**Habitat:** Hot humid climate with a biphasic rainfall pattern, no other specific details known.

**Description:**

Bulb pear shaped, covered with a tan-brown tunic, 5.5-8.5cm in diameter, with a very short to non-existent underground neck <3cm long. Leaves 5-10, low arching and lateral spreading, forming a rosette, channeled with midline thickening but lacking a distinct depressed midrib effect, strap shaped and tapering to a somewhat blunt acute tip, longitudinal parallel nerves faintly visible on the ventral surface, bluish-green, with a red border along the margins about 1mm wide, margins ciliate, containing tiny wooly fibers when torn apart, maximum length 39-67cm, maximum width 2.9-4.7cm. Scape arising from the ground, compressed, dull bluish green turning lighter colored with aging, 23-33cm long. Spathe composed of

two principal bracts about 6cm long, with a few small filamentous bracts sometimes present, spreading and beginning to wither or completely withered at anthesis. Umbel 4-12; flowers actinomorphic, erect to suberect, white with greenish bands on the dorsal petal keels; pedicellate, with pedicels measuring 0.6-2.2cm long; opening at night, scentless. Buds initially erect, then moving to an inclined but not vertical position the day prior to anthesis, before moving to a suberect or erect position at anthesis. Ovary shiny chartreuse green, about 10 x 7mm. Perianth tube dull chartreuse green becoming lighter colored distally, straight at anthesis, 17.5-24.0cm long. Segments lanceolate, with a greenish dorsal keel more pronounced on the outer segments, reflexed at the throat and bowed, unequal with the outer usually slightly longer and slightly narrower than the inner, 6.8-8.9cm long by 0.8-1.2cm wide. Filaments uniformly spreading and bowed, white proximally and pinkish distally, unequal with the inner usually slightly longer than the outer, 5.6-7.8cm long; anthers curved at anthesis, dark colored at maturity; pollen golden yellow. Style white proximally and pink distally, 6.0-8.3cm long; small capitate stigma. Fruit globular to oblong ovoid, with vague longitudinal grooves on the surface, light green, 4.8 x 4.2 x 5.7cm to 4.0 x 3.8 x 4.8cm, with an apical projection (residual perianth tube) 1.5-11.0cm long. Seeds smooth, light green, ovoid to angulated from compression by adjacent seeds, 7-12/fruit, measuring 0.9-2.1cm in diameter.

### **All photographs by the author**

#### **ACKNOWLEDGEMENTS**

Botanical artist Kristin Jakob of Mill Valley, California is acknowledged for the illustration of *Crinum rubrimarginatum*.

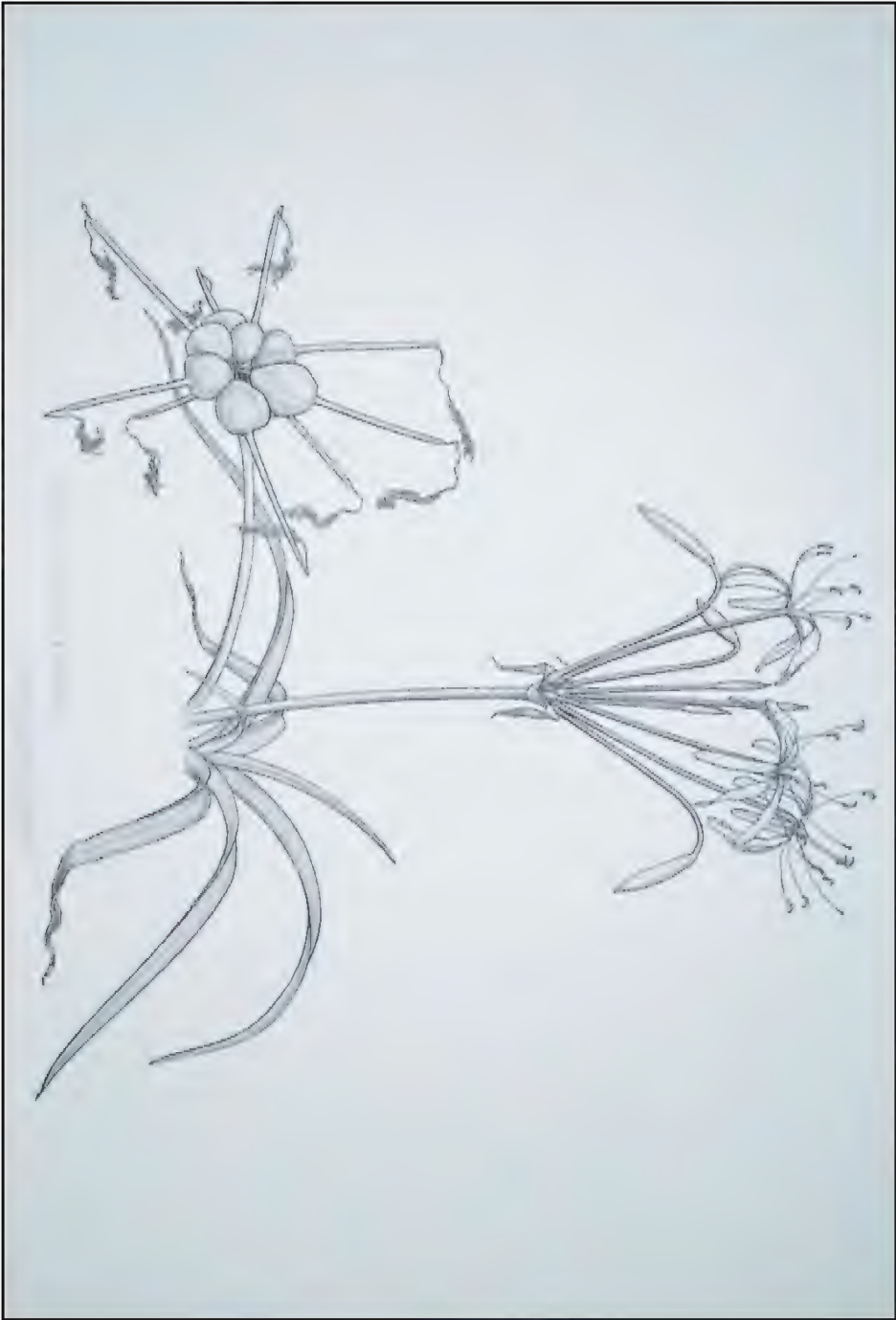
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**Fig. 11.** Field collected bulbs of *Crinum xerophilum* (Perrier) ex Lehmillier. Note the very long underground necks. Photograph taken in southwest Madagascar following collection near Tuléar (Toliara) on January 7, 1998.

**Fig. 12.** Illustration of *Crinum rubromarginatum* Lehmler by Kristin Jakob.





## CRINUM NEROANUM, A NEW SPECIES FROM NORTHERN MADAGASCAR (AMARYLLIDACEAE)

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### INTRODUCTION

When the original bulbs of *Crinum hanitrae* Lehmiller & Sisk were collected amongst sand dunes near the ocean in far north Madagascar in December 2005, only one bulb was blooming. The collector, Jurgen “Nero” Spannring, a Dutch employee of Olaf Pronk in Antananarivo, did not describe the flower in bloom. The bulbs were remarkable in that they possessed very wide leaves, quite unlike other Malagasy *Crinum*. Flowering size bulbs were later obtained by two of us (DJL & ALS) in 2007 via a bulb importer in the USA (Out Of Africa, Inc. – later visited by DJL in 2007) who was associated with Pronk. This resulted in the subsequent publication of *Crinum hanitrae*, a species that corresponded to a photograph originally taken by Pronk in January, 2006 of a bulb with sprawling wide leaves lacking a depressed midrib which was displayed in our account (Lehmiller & Sisk, 2008).

Sisk later obtained additional bulbs from the original collection, and he noted that there were two bulbs which possessed different leaves, exhibiting prominent red coloration at their bases (Fig. 1) quite unlike *C. hanitrae*. He sent one bulb to Lehmiller who cultivated it in his greenhouse, while Sisk initially cultivated his in a pot but then transferred it to the ground

in Central Texas. Lehmiller's bulb flowered in January 2009 while leafless and under dry dormant conditions, its pot having not been watered for 3 months. It had been apparent from its sturdy leaves with prominent depressed midribs during the preceding growing season (Fig. 2) that it was a different species from *C. hanitrae*, and indeed its actinomorphic flowers were typical subgenus *Crinum* in form (Fig. 3) and quite unlike the zygomorphic flowers of *Crinum hanitrae* which had extremely short filaments and non-emergent styles. The bulb bloomed a second time in September 2009 when in leaf, but the leaves were now long, arching, falling down and in or nearing a state of going into dormancy (Fig. 4); this was the only time this bulb ever bloomed in the presence of leaves. We informally referred to this new *Crinum* as 'Red Broadleaf'.

Unfortunately Sisk's bulb eventually proved not to be hardy as it did not survive outdoors in the Central Texas winters, and it never bloomed. Lehmiller's bulb bloomed each subsequent January in 2010, 2011 and 2012 under similar dormant growing conditions, twice with 2 nearly simultaneous scapes (Fig. 5), but it rarely produced a small seed when self pollinated. Clearly this was another Southern Hemisphere bulb that was not going to adapt its growing cycle to the Northern Hemisphere (see Lehmiller, 2012-2013a).

In February 2012, IBS member James Zimmerman inquired of Lehmiller about the identity of *Crinum hanitrae*, having obtained one of the original collection bulbs from Out of Africa at the same time that Sisk had obtained his additional bulbs. Zimmerman's bulb had flowered in the absence of leaves in February 2012 for the first time and did not match the description or photographs of *C. hanitrae*. Indeed, Zimmerman had received another bulb of 'Red Broadleaf'; he self-pollinated it, and one flower eventually developed a 'normal appearing' fruit with a long apical projection (Fig. 6) and bearing a solitary 3.0cm diameter seed with an irregular rough surface, and two smaller fruit developed which contained single small seeds. Zimmerman collected pollen from his flowering bulb and sent it to Lehmiller to use at the next flowering.

During the growing season of 2012, Lehmiller ceased watering his bulb of 'Red Broadleaf' in mid October, and by December it had become leafless. This time, rather than continue dry dormancy over winter as in the past, the bulb was watered beginning on December 5<sup>th</sup>. After two weeks, a large healthy scape appeared, flowering on January 2, 2013, with a second



**Fig. 1.** Dark-red basal leaf coloration in 'Red Broadleaf' (*Crinum neroanum*), originally noted by Sisk in May 2007. (Photograph by Alvin Sisk)



**Fig. 2.** 'Red Broadleaf' (*Crinum neroanum*) demonstrating a rosette of sturdy radiating leaves held well off the ground on June 11, 2008. Note the 'temporary' dark red pseudoneck.





**Fig. 3.** Initial blooming of 'Red Broadleaf' (*Crinum neroanum*) January 18, 2009 in the absence of leaves under dry winter dormancy.



**Fig. 4.** The only observed blooming of 'Red Broadleaf' (*Crinum neroanum*) in the presence of leaves late in the growing season, September 15, 2009. Note the leaves are arching and beginning to sprawl, and the scape is very short. The depressed midribs in the leaves are readily apparent.





**Fig. 5.** 'Red Broadleaf' (*Crinum neroanum*) blooming under dry dormancy with 2 scapes, January 25, 2011.



**Fig. 6.** *Crinum neroanum* in fruit from self pollination, April 14, 2012. (Photograph by James Zimmerman)

scape beginning to emerge (Fig. 7 – 10). The flowering parts were larger/longer than observed when this bulb previously had bloomed except for the one occasion in September 2009 (Fig. 4), probably owing to watering of the pot. The refrigerated stored pollen from Zimmerman's bulb was applied to multiple flowers on both scapes, but no seeds formed. Perhaps the pollen was no longer viable. A third scape unexpectedly began to develop in mid February, still was no evidence of leaf development.

Lehmiller forwarded fresh pollen to Zimmerman who also had begun watering his dormant bulb in December, and Zimmerman was rewarded with two scapes in early-mid January, 2013. Using the now fresh pollen from Lehmiller, Zimmerman's bulb responded by forming multiple fruit with apical projections (Fig. 11) on the initial scape, the seeds still being immature in mid February 2013, the time when this manuscript was concluded. Zimmerman also forwarded fresh pollen to Lehmiller to employ on his third scape.

## DISCUSSION

Although our acquisition of the bulbs of 'Red Broadleaf' did not follow the normal pattern for discovery of a new species, we do know for certain that the bulbs were collected by Spannring east of Ramena in sand dunes near the ocean in far north Madagascar. That these bulbs were confused with bulbs of *C. hanitrae* occurring at the same locality was not surprising since both species possessed wide leaves and only a single collected bulb had bloomed. It was early in the rainy season when Spannring collected the bulbs, December being the usual onset of the summer rains at the locality. Spannring did report one observation of interest: the leaves on the bulbs were prostrate upon the ground.

This latter piece of information, in conjunction with the collection date and with subsequent cultivation observations, provides a clue to explain the setting. Bulbs of *C. hanitrae* possess wide leaves which soon becomes sprawling upon the ground, and this species does not bloom until after its leaves have appeared. In contrast, leaves of 'Red Broadleaf' are sturdy and held well off the ground until late in the growing season before they become arching and eventually sprawling upon the ground; this species normally blooms early in the rainy season in the absence of leaves (hysteranthous) or with the declining remains of the previous growing season's leaves. The latter is what we presume was the situation (sprawling

leaves) when Spannring discovered the bulbs of the two species growing in the same general locality.

That ‘Red Broadleaf’ is a unique species among Malagasy *Crinum* is readily apparent. It’s sturdy wide leaves (>70mm wide) bearing a prominent depressed central midrib, very short scapes and absence of a significant permanent pseudoneck set it apart from any other Malagasy species belonging to subgenus *Crinum* (see Lehmiller, 2012-2013b). The plant is named in honor of the collector, Jurgen ‘Nero’ Spannring (Fig. 12).

***Crinum neroanum*** Lehmiller, Sisk & Zimmerman, **sp. nov.**

***Holotype:*** **Madagascar.** Baie de Sakalave, east of Ramena, December 2005, ex hort. January 25, 2011, Lehmiller **1970** (TAMU) (Fig. 13). (Fig. 14)

***Habitat:*** Sand dunes, near the ocean.

***Description:***

Bulb a somewhat flattened globe covered by a thick brown papery tunic, lacking an underground neck or a significant permanent aboveground pseudoneck, 9.5-13.0cm in diameter. Leaves 8-13, arising after flowering, producing a temporary short pseudoneck about 3-4cm long that is dark red colored, forming a classic rosette of outward radiating sturdy leaves held well off the ground – sprawling leaves on the ground not occurring until late in the growing season, lanceolate, mildly channeled, bearing a prominent depressed central midrib, distal tip bluntly acute, margins entire, longitudinal parallel veins visible on the ventral surface, containing scant tiny woolly fibers when torn across, maximum length 57-63cm, maximum width 7.3-9.3cm. Scape short, compressed, either green or dull reddish colored, 3-26cm long. Spathe composed of two principal bracts, reddish colored, spreading and persistent at anthesis or beginning to wither, 7.5-13.5cm long by 4.5-7cm wide at the base; with multiple filamentous bracts present measuring 1-4mm wide, the number nearly correlating with the number of flower buds. Umbel 8-21; flowers actinomorphic, subsessile, opening at night, pleasantly scented. Buds initially vertical, then inclining to near horizontal in an outward direction the day before anthesis, before returning to align with the perianth tube in either a suberect or erect position at anthesis. Perianth tubes straight at anthesis, with the outer perianth tubes inclined outwardly at a suberect

orientation, light green but sometimes with proximal pinkish green coloration, 12-19.5cm long. Segments lanceolate, white, broadly recurved, with the outer segments having small green apiculates, often unequal with the inner tending to be shorter and wider, 7.2-10.7cm long and 0.8-1.5cm wide. Filaments radially spreading and bowed, white proximally and pinkish purple distally, unequal with the inner slightly longer, 6.1-7.8cm long; anthers turning dark and becoming curved at anthesis, about 1.0cm long; pollen golden yellow. Style pinkish purple, 1.9-7.8cm long; stigma capitate. Ovary shiny medium green, 1.3-1.5cm long by 0.8-0.9cm diameter. Fruit globular, shiny green, circa 2.5-3.7cm diameter, with an apical projection (residual perianth tube) measuring 3.0–12.2cm long; data collection incomplete on seeds.

### **All photographs by David Lehmiller except where indicated**

#### **ACKNOWLEDGEMENTS**

Olaf Pronk is to be commended for his recognition of potential new *Crinum* taxa in Madagascar. We appreciate the assistance that Mike and Maureen Massara of Out Of Africa gave us in acquiring the original specimens from Pronk. Botanical illustrator and IBS member Kristin Jakob of Valley Mill, California is acknowledged for the illustration of *Crinum neroanum*; Ms Jakob is highly recommended for the quality of her artist skills.

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- Lehmiller, D.J. 2012-2013b. Key to the Malagasy species of *Crinum* (Amaryllidaceae). *Herbertia* 66: in press.





**Fig. 7.** A reddish scape arising approximately 2 weeks after initiating watering of a dormant 'Red Broadleaf' bulb (*Crinum neroanum*), December 21, 2012. Note the dark red coloration in the ventral leaf bases which will eventually form the temporary pseudoneck.



**Fig. 8.** Same scape as Figure 6, now 8 days later on December 29, 2012. The scape has grown longer; the spathe spreading to reveal the buds, and a second scape tip has emerged.



**Fig. 9.** Same scape as Figure 7, now 2 days later on December 31, 2012. The lateral buds have begun radiating outward with 2 buds inclining horizontally the day before anthesis. Several of the white filamentous bracts are apparent.



**Fig. 10.** Same scape as Figure 8, now on January 7, 2013. The buds have migrated such that the long-lasting flowers are now aligned much like radiating spokes from a central core. Some of the anthers are missing, having been collected for storage.





**Fig. 11.** Immature fruit developing on *Crinum neroanum*, February 17, 2013. (Photograph by James Zimmerman)



**Fig. 12.** Casual photograph of Jurgen "Nero" Spannring during a hot day at work in Antananarivo, Madagascar, December 6, 2004.



**Fig. 13.** Type specimen of *Crinum neroanum* Lehmiller, Sisk & Zimmerman, Lehmiller **1970** (TAMU).





**Fig. 14.** Illustration of *Crinum neroanum* Lehmiller, Sisk & Zimmerman by Kristin Jakob.

## KEY TO THE MALAGASY SPECIES OF *CRINUM* (AMARYLLIDACEAE)

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### INTRODUCTION

Perrier (1939, 1950) wrote two similar accounts on the genus *Crinum* in Madagascar, listing only 3 species plus varieties, yielding a total of 6 different taxa. Perrier did conduct limited field investigations of the genus and described a new species with two varieties, but when he eventually wrote his accounts many years after his field experiences, he extensively relied upon herbarium specimens that were often collected by others, causing him to confuse disparate taxa.

The current author was introduced to Malagasy *Crinum* through a friendship with D. Hardy (now deceased), former Senior Horticulturist at the National Botanical Institute in Pretoria. Hardy during his lifetime made at least 30 field trips to Madagascar, and he proved invaluable in coordinating the author's field trips, accompanying the author on three occasions. The author conducted four separate collecting trips to Madagascar, plus the author established contact with other Malagasy collectors and was able to acquire multiple additional field-collected specimens over approximately a 20 year period. All species but one listed in the Key were cultivated by the author from field collected specimens, permitting delineation of such features as fruit and seeds.

The purpose of this brief report is to publish a Key for Malagasy *Crinum* and to provide pertinent reference data. Also, a few supplementary and clarifying remarks are included for several species.

### LIST OF SPECIES

#### 1. *Crinum filifolium* var. *brevistylum* Perrier

Bulletin de la Societe Botanique de France 86:90-91, 1939.

Flore de Madagascar 41e:2-10, 1950.

In early December 2004, the author traveled to the region of the holotype collection for *Crinum filifolium*, the Tsingy de Namoroka, a very remote

region in northwest Madagascar requiring a sturdy, 4-wheel-drive pickup truck, an experienced driver (Nero Spannring, a trusted employee of Olaf Pronk in Antananarivo), and a local hunting guide in order to reach the destination. An assumption was made that Perrier made his collections from close to the roadside – in this case being along the road leading from Mitsinjo to Andranomavo, the eastern border of the Tsingy being traversed by this road. (When Perrier made in his collection in 1903, this road would have been a zebu cart or ox cart track; at some later date the track apparently was partially graded with a bulldozer in several stretches and converted into an unpaved road, but it was not being maintained, and travel in some places even by zebu cart was extremely difficult when we visited; see Fig. 1. Regardless, without a local guide we likely would not have found our way to the Tsingy.) In this area, the Tsingy consisted of granite hills arising from a rather flat surrounding terrain. Sadly, there was total habitat destruction of these hills, now completely devoid of the former forest described by Perrier a century ago. We searched in vain about the hills, now severely eroded, populated only by grasses and a few ground orchids, and extensively crisscrossed with farm animal paths. While we were there, locals were actively burning the grasses on several



**Fig. 1.** A section of “road” between Mitsinjo to Andranomavo. Had it been raining, travel by a 4-wheel drive vehicle likely would have been impossible. Photograph taken by the author on December 3, 2004.



**Fig. 2.** *Crinum filifolium* var. *brevistylum* Perrier. Madagascar, Plateau du Bongolava, October 1962, J. Bosser **720** (TAN). Photograph by the author.



adjacent hills in the native tradition of “enriching the soil”. We inquired of the locals if they had ever observed a small white lily flower; soon they brought us several large bulbs of *C. hildebrandtii* from the nearby river, but they explained that they had never observed a small white lily. Perhaps *C. filifolium* still survived further into the interior of the Tsingy where it was more remote and perhaps where the ecology was better protected.

In 1995 when the author visited the Parc de Tsimbazaza Herbarium (TAN) in Antananarivo, there was a specimen of a very small *Crinum* (Fig. 2), J. Bosser 720, October 1962, that correlated with *C. filifolium*, and as the flowers had no visible filaments or styles, the specimen was thought to represent var. *brevistylum*. The collection site was not very specific though, being listed only as “Plateau du Bongolava”, which would have been in far northwestern Madagascar.

This taxon requires further study which necessitates living plants. Whether there are two species rather than two varieties of a single species, or perhaps just a single species with no varieties, cannot be resolved until additional collections are made.

**2. *Crinum pronkii* Lehmiller**  
Herbertia 63:124-130, 2009.

**3. *Crinum mccoysi* Lehmiller**  
Herbertia 58:111-121, 2003-04.

The holotype collection site for this species was decimated by commercial bulb collectors following its discovery. Associates of Olaf Pronk subsequently discovered a site removed from the holotype locality, confirmed by the author after receiving several bulbs from the second site. A few bulbs at the second site were larger than those at the initial discovery site, with leaves measuring as wide as 3.2cm and umbels having as many as 10 flowers. The location of the second site was being held in secret.

**4. *Crinum modestum* Baker**  
J. Linnean Society 22:528, 1887.  
Bulletin de la Societe Botanique de France 86:90-91, 1939.  
Flore de Madagascar 41e:2-10, 1950.

Bulbs of this species can grow much larger than suggested from published accounts, reaching 12cm in diameter per the author’s experience.

5. *Crinum hanitrae* Lehmiller & Sisk

Herbertia 62:180-187, 2008.

6. *Crinum rubromarginatum* Lehmiller

Herbertia 66: in press, 2012-13.

7. *Crinum xerophilum* (Perrier) ex Lehmiller

Bulletin de la Societe Botanique de France 86:90-91, 1939.

Flore de Madagascar 41e:2-10, 1950.

Herbertia 56:91-95, 2001.

8. *Crinum mauritianum* Loddiges

Botanical Cabinet 7:t.650, 1822.

Kew Bulletin 30:110, 1975.

Herbertia 56:91-95, 2001.

Syn.: *Crinum braunii* Harms (1895)

Syn.: *Crinum voyroni* Jumelle (1924-25)

This species is endemic to the salt water marshes, beaches and tidal waterways of southeast Madagascar where it occurs in very large numbers (Lehmiller, 2001). It should be regarded as having primary origin in Madagascar, not Mauritius – the large bulky and buoyant seeds which it produces in abundance could easily account for spread to adjacent islands in the region, not to overlook the possibility of human transport by seafaring peoples in the past. See the discussion in Lehmiller, 2001.

Plants in shaded, shallow coastal bayous can grow quite large, the author recording measurements on one bulb south of Fort Dauphin (Taolagnaro) in 1996 that had leaves measuring to 167cm long by 11cm wide (flattened width).

9. *Crinum lavrani* Lehmiller

Herbertia 61:120-127, 2007.

Herbertia 61:128-133, 2007.

10. *Crinum neroanum* Lehmiller, Sisk & Zimmerman

Herbertia 66: in press, 2012-13.

# 11. *Crinum hildebrandtii* Vatke

Monatsschrift der Koniglichen Preussischen Akademie der Wissenschaften zu Berlin pp.863-864, 1876.

Flore de Madagascar 41e:2-10, 1950.

Herbertia 48:70-73, 85, 1992.

Perrier (1950) very much muddled the identity of *C. hildebrandtii*, even omitting reference to Malagasy herbarium specimens at Kew labeled as such which surely he reviewed when he studied Kew's Madagascar *Crinum* herbaria (Lehmiller, 1992).

During my first visit to Madagascar in 1995, while exploring portions of the National Park at Andasibe, I encountered a group of groundskeepers in the forest. One of the groundskeepers inquired as to my interest, and I told him that I was studying indigenous *Crinum*. He responded that he was familiar with *Crinum* and that there were two species at Andasibe – I wholeheartedly agreed as I had already observed *C. ligulatum* and *C. hildebrandtii* in the Park.

If there are two Malagasy species that could easily be confused in herbaria, it would be *C. ligulatum* and *C. hildebrandtii*, but in living specimens the differentiation is not difficult, to which even the fore mentioned groundskeeper could attest. In living plants, the differences are: 1) Mature leaves of *C. hildebrandtii* are wider than leaves of the same length of *C. ligulatum*; 2) Leaves of *C. hildebrandtii* are suberect and tend not to become arching until they become older, whereas early leaves of *C. ligulatum* very quickly become arching; 3) Lateral to the depressed midrib, the leaf substance of *C. hildebrandtii* is thin and pliable whereas it is thicker and sturdier in *C. ligulatum*; 4) Longitudinal parallel nerves within the leaves of *C. hildebrandtii* are spaced apart whereas they are closely aligned in *C. ligulatum*; 5) Leaf tips are acute and bordered by prominent fold creases in *C. hildebrandtii* whereas the tips are more pointed without fold creases in *C. ligulatum*; 6) Perianth tubes of *C. hildebrandtii* are longer, 15-21cm, versus <14cm for *C. ligulatum*; 7) Flowers in *C. hildebrandtii* are erect whereas lateral flowers in the umbel of *C. ligulatum* are suberect to almost horizontal in large umbels; 8) Umbels of *C. hildebrandtii* are less than 20 whereas they are sometimes >20 and rarely as many as 30+ in *C. ligulatum*; 9) *Crinum hildebrandtii* tends to occur at lower altitudes and favors shaded areas prone to be inundated from seasonal flooding, whereas *C. ligulatum*, the most common species in the central plateau region of

Madagascar, usually is seen forming a clump of bulbs (via offsetting) in sunny locations on the elevated banks of temporary streams.

Recent literature also contributes to misidentifications. In *Flowering Plants of Africa* t.1874 (Verdoorn, 1983), the plant illustrated and identified as *C. firmifolium* (Hardy 2995, offsets of which I have maintained in cultivation for many years), is actually *C. ligulatum*, although the illustration and uncolored drawing could almost pass for *C. mauritianum*. The subsequent illustration in *Flowering Plants of Africa* t.1875 (Verdoorn, 1983), identified as *C. asiaticum*, is *C. hildebrandtii* – *C. asiaticum* is not indigenous to Madagascar.

## 12. *Crinum ligulatum* Baker

J. Linnean Society 20:270-271, 1884.

See the discussion under 11. *Crinum hildebrandtii*.

## 13. *Crinum firmifolium* Baker

J. Linnean Society 20:270, 1884.

This plant is one of the largest *Crinum* in Madagascar, although it does not possess the widest leaves. Lacking both a pseudoneck and a depressed midrib in its leaves, it is not easily confused with either *C. hildebrandtii* or *C. ligulatum*, and therefore Perrier's accounts (1939, 1950) should be disregarded. I have observed it in southeast Madagascar near Fort Dauphin (Taolagnaro) as well as in far northwest Madagascar west of Mahajanga.

## 14. *Crinum razafindratsiraea* Lehmiller

Herbertia 55:130-133, 90, 2000.

The original holotype site is being encroached by human habitation and its long term survival is in doubt, not to mention the deleterious effects of bulb collectors. However, Olaf Pronk has discovered a second distant location, verified by the author, the location of which is being kept a secret.

## 15. *Crinum hardyi* Lehmiller

Herbertia 58:111-121, 2003-04.

In addition to the published collection sites in West Madagascar (Lehmiller, 2003-04), the author has also observed this species in northwest Madagascar west of Mahajanga.



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KEY TO MALAGASY SPECIES OF THE GENUS *CRINUM*.

1. Flowers zygomorphic, filaments short, style usually non-emergent.....2
1. Flowers actinomorphic, filaments long & radially dispersed .....6
2. Leaves <3mm wide, umbel 1-2 flowers.....*C. filifolium* var. *brevistylum*
2. Leaves >10mm wide .....3
3. Leaves <35mm wide, green, margins denticulate.....4
3. Leaves >40mm wide .....5
4. Umbel 1-3 flowers, perianth tubes straight, flowers erect.....*C. pronkii*
4. Umbel 1-10 flowers, perianth tubes curved, flowers horizontal... *C. mccoyi*
5. Leaves 47-66mm wide, bluish green, margins serrate..... *C. modestum*
5. Leaves 72-160+mm wide, green, margins entire.....*C. hanitrae*
6. Flowers pedicellate, leaf margins ciliate .....7
6. Flowers sessile/subsessile, leaf margins denticulate or entire.....8
7. Leaves bluish green, 32-47mm wide, red border on leaf margin,  
no floral scent .....*C. rubromarginatum*
7. Leaves dark green, 40-110mm wide, floral scent putrid .... *C. xerophilum*
8. Leaves U-shaped in cross section, sturdy, margins entire ....*C. mauritianum*
8. Leaves channeled but not U-shaped in cross section .....9
9. Leaves with a depressed midrib; plants with or without a pseudoneck.... 10
9. Leaves lacking a distinct depressed midrib; plants lacking a pseudoneck ..... 13
10. Leaves with denticulate margins; plants lacking a pseudoneck....*C. lavrani*
10. Leaves with margins entire (or with sparse microscopic teeth) ..... 11
11. Plants lacking a permanent pseudoneck, leaves >70mm wide..*C. neroanum*
11. Plants with a prominent permanent pseudoneck, leaves  
<80mm wide..... 12
12. Leaves with prominent distal fold creases, acute tips & thin consistency;  
perianth tubes 15-21cm long, flowers erect .....*C. hildebrandtii*
12. Leaves with pointed tips & firm consistency; perianth tubes <14cm  
long, flowers spreading laterally in umbel..... *C. ligulatum*
13. Leaves with entire margins, >60mm wide..... *C. firmifolium*
13. Leaves with denticulate margins ..... 14
14. Leaves 20-32mm wide, buds vertically drooping prior to  
anthesis.....*C. razafindratsiraea*
14. Leaves 42-70mm wide, buds inclining prior to anthesis..... *C. hardyi*

## A SYNOPTIC REVIEW OF *SCADOXUS* RAF. (AMARYLLIDACEAE) WITH NOTES ON CULTIVATION

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### INTRODUCTION

The genus *Scadoxus* was established by the 19<sup>th</sup> century French biologist Constantine Rafinesque who first published it in the 4<sup>th</sup> part of his *Flora Telluriana*, with *S. multiflorus* (Martyn) Raf. as the type species (Rafinesque, 1838). Following his new genus name, Rafinesque added the abbreviation “umb. glor.” (glorious umbel), but although ‘doxus’ aptly translates to ‘glorious’ in Greek, ‘sca’ means obscure, which is somewhat antithetic. *Scadoxus multiflorus* had earlier been described as *Haemanthus multiflorus* Martyn by the English cleric and Professor of Botany in the University of Cambridge, Thomas Martyn, who published a short description of it in 1795, accompanied by a coloured engraved plate by F.P. Nodder. Linnaeus had earlier established the genus *Haemanthus* L. in 1753 in his *Species Plantarum*, in which he briefly described the first member of that genus, *H. puniceus* L. (now *Scadoxus puniceus*). Following a critical evaluation of morphological features by Björnstad & Friis (1972a, b; 1974) and Müller-Doblies & Müller-Doblies (1975), it was concluded that *Haemanthus s.l.* (in the broad sense) encompassed two morphologically and cytologically divergent groups, i.e. subgenus *Nerissa* and subgenus *Haemanthus*, which lead to the division of *Haemanthus s.l.* into *Haemanthus s.str.* (in the strict sense) and *Scadoxus* by Friis & Nordal (1976).

The two genera are separated by five key characters: rootstock type (a distinct rhizome in *Scadoxus*, sometimes with a bulbous upper part, versus a true bulb in *Haemanthus*), presence or absence of leaf petioles (present in *Scadoxus* versus absent in *Haemanthus*), leaf arrangement (alternate or not distinctly distichous in *Scadoxus* versus distinctly distichous or solitary in *Haemanthus*), leaf texture (thin-textured with a distinct midrib on the

lower surface in *Scadoxus* versus thick and fleshy and without a midrib in *Haemanthus*), and basic chromosome number ( $x = 9$  in *Scadoxus* versus  $x = 8$  in *Haemanthus*). *Scadoxus* and *Haemanthus* are further separated by distribution differences; *Haemanthus* is concentrated mainly in winter rainfall parts of western and southern South Africa, extending to summer rainfall parts in the east and north of the country and in Namibia (Snijman, 1984), whereas *Scadoxus* ranges mainly in Tropical Africa, extending to eastern South Africa and Tropical Arabia.

Within the family Amaryllidaceae, *Scadoxus* falls into subfamily Amaryllidoideae and is a member of tribe Haemantheae which includes *Apodolirion*, *Clivia*, *Cryptosteophanus*, *Gethyllis* and *Haemanthus* (Chase *et al.*, 2009; Meerow & Clayton, 2004). *Scadoxus* currently has nine species (11 taxa), belonging to five sections, section *Scadoxus* (*S. multiflorus*, *S. pole-evansii*), section *Gyaxis* (*S. puniceus*, *S. membranaceus*), section *Demeusea* (*S. cinnabarinus*, *S. longifolius*, *S. pseudocaulus*), section *Gamolepis* (*S. nutans*) and section *Choananthus* (*S. cyrtanthiflorus*) (Friis & Nordal, 1976). The genus comprises both evergreen and deciduous members and the rootstock is essentially rhizomatous, sometimes with a bulbous upper part. In all species except *S. cinnabarinus*, *S. longifolius* and *S. membranaceus*, the sheathing, petiole-like leaf bases form a short to long pseudostem. The scape arises laterally, next to the pseudostem, or in some species it may arise within the pseudostem and either rupture it near the base or appear between the leaves, and in those members which lack a pseudostem it arises between the petiole bases. The flowerhead has either a brush-like form, or is more or less spherical, and the fruits are fleshy berries, containing one to several globose or ovoid seeds with green embryos. Whereas the work of Friis & Nordal (1976) was based entirely on morphology, a current project of the Natural History Museum at the University of Oslo, Norway is being undertaken by Professors Charlotte Sletten Bjorå and Inger Nordal, focusing on the evolutionary history and phylogeny of *Scadoxus* and its adaptation to a changing environment, with particular focus on the shifts in habitats from savannas to rainforest.

*Scadoxus* is endemic to Africa and the Arabian Peninsula. Its distribution extends from coastal scrub near Bredasdorp in the southern Cape of South Africa (*S. puniceus*) to the Raida Escarpment in the Asir Mountains of southwestern Saudi Arabia, where *S. multiflorus* subsp. *multiflorus* occurs in high altitude montane woodland from 2200–2700m.



The genus is represented in all African countries south of the Sahara Desert and absent only from the northern parts in Western Sahara, Morocco, Algeria, Tunisia, Libya and Egypt. In Tropical Arabia it occurs in Yemen, Oman and Saudi Arabia, and is also encountered in a number of outlying islands including Yemen's Socotra Island in the Arabian Sea, several islands belonging to Equatorial Guinea in the Gulf of Guinea, Mozambique's Inhaca Island, and the Seychelles, but is absent from Madagascar.

Most species are native to tropical climates with the exception of *S. membranaceus* (from South Africa) and *S. multiflorus* subsp. *katharinae* (from South Africa, Swaziland and Mozambique), which are restricted to subtropical parts, and *S. puniceus* is native mainly to subtropical South Africa but extends into Tropical Africa. *Scadoxus multiflorus* subsp. *multiflorus* is the most widely distributed taxon, ranging across all of Tropical Africa into northeastern South Africa, northern Botswana and Namibia, and the Arabian Peninsula, and *S. cinnabarinus* and *S. pseudocaulis* are widely distributed in West and Central Africa. By contrast, *S. cyrtanthiflorus* (Democratic Republic of Congo and Uganda), *S. nutans* (Ethiopia) and *S. pole-evansii* (Zimbabwe) are endemic to highly specific habitats and have very narrow ranges. Most species are usually associated with lightly to heavily shaded habitat and this is fairly varied, including lowland forest on sea-facing dunes, swamp and montane forest, woodland, bushveld and grassland. They are often encountered along watercourses and some occur as lithophytes or epiphytes. *Scadoxus puniceus* is exceptional in that certain forms occur naturally in full sun.

Little is known of the pollination biology of *Scadoxus*, but in South Africa sunbirds and weaver birds feed on the nectar of *S. puniceus* (Pooley, 1998). The dense and erect, brush-like flower heads of *S. puniceus* and *S. membranaceus* are also visited by honey bees. The nodding perianth tubes of *S. nutans* contain plentiful nectar and are probably bird-pollinated, as are those of the pendent, scarlet-flowered *S. cyrtanthiflorus*. The red-flowered *S. multiflorus* is visited by large butterflies, including swallowtails. The glossy red or orange ripe fruits are eaten by a variety of birds and monkeys, which are instrumental in their dispersal.

*Scadoxus* is an alkaloid-rich, highly toxic genus and all parts of the plant should be regarded as toxic. *Scadoxus cinnabarinus* and *S. multiflorus* are used in Cameroon, Gabon, the Central African Republic and Angola in combination with other plants for arrow poison. In Guinea and northern

Nigeria, plants are used to make a fish poison and the bulb is also used to treat dropsy, scabies and poorly healing wounds. In South Africa, native peoples use the rootstock of *S. puniceus* to treat coughs, headaches, gastrointestinal conditions and poisoning (Pooley, 1998).

With the exception of *S. longifolius* which has yet to be assessed in cultivation, all have been grown at one time or another, yet despite their wide horticultural appeal as container and garden subjects, only *S. multiflorus* subsp. *multiflorus* is currently widely available in commercial trade. Even when not in flower, the ornamental foliage, attractively spotted pseudostems or petioles and basal leaf sheaths, glossy ripe fruits, and sometimes prominent spathe bracts, provide the grower of *Scadoxus* with year-round interest. Within the past decade, new introductions into bulb collections have included *S. pole-evansii*, a plant with enormous horticultural potential, *S. cyrtanthiflorus*, another with strong potential and *S. nutans*, a plant more suited to the specialist collector. *Scadoxus cinnabarinus* and *S. multiflorus* subsp. *longitubus* were cultivated in the latter half of the 19<sup>th</sup> Century but lost; the former is now in cultivation again but the latter has yet to be re-introduced. *Scadoxus* are cold tender plants and require greenhouse protection when grown in cold climates. Those from southern Africa require a minimum of 5°C, whereas those from tropical parts need a minimum of 10°C (Hutchinson, 2007). Most species produce offsets and propagation is easily achieved from seeds sown as soon as the berries have turned bright yellow, orange or red; flowering can be expected from the third year onwards (Du Plessis & Duncan, 1989).

The genus has not featured highly in hybridization experiments and this should not be surprising, considering its inherent showiness, vigour and ease of cultivation in suitable conditions. Historical hybrids of *Scadoxus* have recently been documented (David, 2006) and of the few that have survived, the best known is *S. x hybridus* 'König Albert', a cross between *S. puniceus* (pod parent) and *S. multiflorus* subsp. *katharinae* (pollen parent), raised by Johannes Nicolai in Coswig-Dresden, Germany in 1899 (Wittmack, 1900).

## THE SCADOXUS SPECIES

***Scadoxus cinnabarinus*** (Decne.) Friis & Nordal

***cinnabarinus***: red tinted with orange; descriptive of the tepal colour.

*Historical notes*: The plant was originally collected by the Belgian-born

botanist Joseph Decaisne (1807-1882) in Gabon and described by him as *Haemanthus cinnabarinus* Decne. in the Belgian horticultural journal *Flore des Serres et des jardins de l'Europe*, in which it was recommended as a plant for the hot greenhouse (Decaisne, 1857). Unfortunately Decaisne's type material was lost and the colour plate (t.1195) accompanying his text in *Flore des Serres* was designated as the lectotype (Björnstad & Friis, 1972b). The morphological variation within the species led to the plant being independently described a further 19 times under the genus *Haemanthus*. **Brief description:** Plant fully evergreen, up to 600mm high, clump-forming, terrestrial; pseudostem absent. *Rootstock* a short erect rhizome, sometimes with a bulbous upper part, multiplying by stolon formation. *Leaves* 2–4, occasionally 5, lanceolate to oval, 120–200 x 70–140mm; petioles 100–320mm long, arising directly from the rhizome. *Scape* arising between the petiole bases, 150–300mm long, green, light green or flushed with maroonish brown; pedicels 12–25mm long, green. *Flowerhead* spherical, 20–80-flowered; perianth tube 3–10mm long; tepals narrowly lanceolate, 14–28mm long, light to bright orange-red or pinkish-red. *Filaments* shortly- to well exserted, light orange-red. (**Fig. 1.**)

**Flowering time:** January-April.

**Distribution and habitat:** *Scadoxus cinnabarinus* is native to tropical rain forest and is widely distributed in West and Central Africa, extending from Sierra Leone to Angola. The plant occurs in leaf litter of the forest floor, forming small colonies through stolon formation from the rhizome.

**Cultivation:** This beautiful evergreen species likes a warm and shaded, humid environment and its relatively dwarf stature renders it most suitable as a container subject. It likes a humus-rich, well drained, slightly acid medium such as equal parts of composted bark, peat moss and coarse grit, and watering about once per week throughout the year. The leaves are reminiscent of those of *S. membranaceus* and the flower head resembles that of *S. multiflorus*, but is usually smaller and has fewer flowers, with lanceolate tepals. Like those of *S. membranaceus*, the leaves last for well over one year.



**Fig. 1.** The evergreen *Scadoxus cinnabarinus* from West Africa.



***Scadoxus cyrtanthiflorus* (C.H. Wright) Friis & Nordal**

***cyrtanthiflorus*:** flowers resembling those of long-tubed *Cyrtanthus* species.

***Historical notes:*** This remarkable plant was originally described as *Haemanthus cyrtanthiflorus* C.H. Wright by the American botanical collector, Charles Wright (1811-1886) in the *Journal of the Linnean Society* (Wright, 1906). The type material in the Kew Herbarium was collected in the Rwenzori Mountains in Uganda by Baur in 1905. Three years later, A.B. Rendle described the same species under a new genus, *Choananthus* Rendle in the *Journal of Linnean Society*, as *C. wollastoni* Rendle, from material collected by A.F.R. Wollaston in the Rwenzori Mountains (Rendle *et al.*, 1908). It proved to be merely a more robust specimen of *Haemanthus cyrtanthiflorus* and the name was placed in synonymy by Friis & Nordal (1976) when they recognized *Scadoxus* Raf. and made the new section *Choananthus* (Rendle) Friis & Nordal, of which *S. cyrtanthiflorus* is the sole member.

***Brief description:*** Plant fully evergreen, 400–800mm high, solitary, terrestrial or lithophytic, occasionally epiphytic; pseudostem well developed, light green flushed with brownish maroon. *Rootstock* a solitary, short to long, erect or creeping rhizome with an ovoid bulbous upper part. *Leaves* 2–6, elliptical, 200–300 x 65–80mm; petioles 20–40mm long, arising from top of pseudostem. *Scape* arising within pseudostem, rupturing it and emerging near base, 300–330mm long, light green or flushed with brownish maroon. *Flowerhead* more or less spherical, 12–24-flowered, always carried below the leaves; pedicels arcuate, 25mm long, green; perianth pendent, tube 30–40mm long, tepals lanceolate, 12–13 x 3–4mm, scarlet. *Filaments* included, 6mm long, scarlet. *Berries* globose, ovoid or irregularly shaped, bright red or orange. (**Fig. 2.**)

***Flowering time:*** January–March.

***Distribution and habitat:*** *Scadoxus cyrtanthiflorus* is only known from tropical montane rainforest of the Rwenzori Mountains straddling the border between the eastern Democratic Republic of Congo and western Uganda. It occurs in dense colonies in light to heavy shade between 2300–2700m. It is mostly terrestrial or lithophytic, but occasionally grows on tree trunks. The area experiences heavy rainfall with a warm and humid daytime climate followed by bitterly cold conditions at night. The plants are solitary and reproduce by seed; their very long-tubed flowers are almost certainly adapted to bird-pollination.



**Fig. 2.** The arching pedicels and pendent flowers of *Scadoxus cyrtanthiflorus* from the Rwenzori Mountains, Uganda. Photograph by Dennis Tsang.

**Cultivation:** The species can be regarded as fully evergreen as the new leaf shoots appear before the old ones have withered. It performs well in lightly to heavily shaded conditions in a slightly acid, well drained, humus-rich medium. The plants require regular heavy watering throughout the year, especially in spring and early summer when the new leaf shoots appear.

***Scadoxus longifolius*** (De Wild. & T. Durand) Friis & Nordal

***longifolius:*** descriptive of the very long, narrow leaves.

**Historical notes:** This is the least well known of all the *Scadoxus* species and the only record is a single specimen collected in the Democratic Republic of Congo in 1891. The plant has never been illustrated, no details exist of where it was found, and its tepal colour is unknown. The type specimen is housed in the herbarium of the National Botanic Garden of Belgium in Brussels and was collected by the Belgian Fernand Demeuse (1863-1915), and originally published as *Demeusea longifolia* De Wild. & T. Durand in Volume 39 of the *Bulletin de la Societe Botanique de Belgique* (De Wildeman & Durand, 1900). The species became *Haemanthus longifolius* Traub when it was transferred to that genus in *Plant Life* by H.P. Traub in 1952.

**Brief description:** *Plant* probably fully evergreen, up to 200mm high, terrestrial; pseudostem absent. *Rootstock* a short, erect rhizome. *Leaves* 7, narrowly lanceolate, 400 x 20mm, margins heavily undulate; petioles 110–125mm long, arising directly from the rhizome. *Scape* arising between petiole bases, 50mm long, lengthening to 200mm after anthesis; pedicels 7mm long, erect, lengthening to 20mm after anthesis. *Flowerhead* brush-like, many-flowered, 20–30mm wide, surrounded by 4 prominent spathe bracts; perianth tube 0.8mm long; tepals linear-elliptical, 4.5–5.5mm long, 0.6mm wide, colour unknown. *Filaments* 2mm long. *Berries* unknown.

**Flowering time:** unknown.

**Distribution and habitat:** Only recorded from the Democratic republic of Congo, exact location and habitat unknown.

**Cultivation:** The plant has not yet been recorded in cultivation.

***Scadoxus membranaceus*** (Baker) Friis & Nordal

**Common name:** ‘Dwarf Paintbrush’

***membranaceus:*** descriptive of the membranous outer texture of the prominent spathe bracts.

**Historical notes:** The plant was originally described as *Haemanthus membranaceus* Baker by the Kew botanist J.G. Baker in his *Handbook of the Amaryllideae*, in 1888, from specimens collected by W.T. Gerrard in KwaZulu-Natal in 1865, and from additional material collected by Harvey at Peddie in the Eastern Cape. It was re-assessed as *S. puniceus* var. *membranaceus* by Baker in *Flora Capensis* (1896) but returned to its original status by Friis & Nordal (1974).

**Brief description:** *Plant* fully evergreen, up to 500mm high, clump-forming, terrestrial; pseudostem absent. *Rootstock* a short, erect rhizome, multiplying by offset formation. *Leaves* 2–7, broadly lanceolate, 140–300 x 30–135mm, spreading to suberect, with prominent midrib on lower surface and slightly to strongly undulate margins; petioles 90–200mm long, heavily spotted, arising directly from rhizome. *Scape* arising between petiole bases, 100–250mm long; pedicels 3–4mm long. *Flowerhead* brush-like, enclosed by 4–5 shiny reddish brown shiny spathe bracts; tepals linear, erect, light red. *Filaments* shortly- to well exerted, orange. *Berries* large, globose or ovoid, on erect pedicels, deep glossy red. (**Fig. 3, 4, 5.**)

**Flowering time:** December–April.

**Distribution and habitat:** *Scadoxus membranaceus* is endemic to South Africa's eastern seaboard, occurring along the subtropical coastline of the Eastern Cape and KwaZulu-Natal. It grows in colonies in dappled shade amongst rocks and along river banks, and on sea-facing dunes in low-lying evergreen forest. It is very variable with respect to leaf and flowerhead size, depending on wild provenance. A robust form is native to the Kei River in the Eastern Cape.

**Cultivation:** This long-lived species is of great use to the gardener as it will flower in even dense shade. In addition to its striking flowerheads with large, persistent shiny bracts, its glossy red berries provide colour for months and its lance-shaped leaves remain attractive throughout the year. Its attractively spotted petioles are an added feature. The plants are strongly clump-forming and like to remain undisturbed for at least five years. It is fully evergreen as the new leaves emerge before the older leaves have withered. The roots and rhizomes are extremely susceptible to the 'red blotch' fungal disease caused by the air-borne fungus *Stagnospora curtisii*, which can be controlled to a certain extent by drenching and spraying with copper oxychloride. The foliage is relished by slugs and snails.





**Fig. 3.** *Scadoxus membranaceus* (robust form from the Eastern Cape).



**Fig. 4.** *Scadoxus membranaceus* fruits (robust form from the Eastern Cape).



**Fig. 5.** *Scadoxus membranaceus* (dwarf form from the Eastern Cape).

***Scadoxus multiflorus* (Martyn) Raf.*****multiflorus*:** many-flowered.

This species comprises three taxa; subsp. *multiflorus*, subsp. *katharinae* and subsp. *longitubus*.

The taxa are distinguished mainly by differences in perianth tube length, growth and flowering cycle, height and distribution (see key at end). The well known subsp. *multiflorus* and subsp. *katharinae* are easily distinguishable, but subsp. *longitubus* closely resembles subsp. *multiflorus*, and its distribution range (Guinea to Ghana in West Africa) overlaps with that of the widespread subsp. *multiflorus*.

**a. subsp. *multiflorus*****Common name:** ‘Fire-ball Lily’

***Historical notes:*** The plant featured in illustration as early as 1623 in an etching by Pierre Vallet, gardener to King Henry IV of France, on plate 42 of his tome *Le jardin du Roy très chrestien Henry IV Roy de France et de Navare*, was published under the name “*Satyrium e Guinea delatii*”. Apart from its importance as the first published illustration of the taxon, it is significant in an ecological sense, for resting on the stamens of the uppermost flowers is a large butterfly. The possibility exists that whoever collected the plant, which probably originated in Guinea in West Africa, may have observed butterflies visiting the flowers and preserved a specimen for later inclusion on the plate; large butterflies are known to visit the flowers of subsp. *multiflorus* and subsp. *katharinae* in the wild in South Africa. Adjacent to the illustration depicting an inflorescence with three leaves, is a rootstock belonging to the genus *Satyrium* (Orchidaceae), included in error.

The plant was first described in binomial form as *Haemanthus multiflorus* Martyn in 1795 by the English Professor of Botany at the University of Cambridge, Prof. Thomas Martyn (1735-1825), accompanied by a coloured engraving by F.P. Nodder, made from a plant which flowered in the Fleet Street nursery of Mr Parker, in 1794. The engraving is the lectotype of the species due to the loss of the type material, originally collected in Sierra Leone. The plant was illustrated in colour numerous times during the early 19<sup>th</sup> Century and described on more than 20 occasions by various authors, under the genus *Haemanthus*, until its final transfer to *Scadoxus* by Friis & Nordal, in 1976.





**Fig. 6.** *Scadoxus multiflorus* subsp. *multiflorus* from the Soutpansberg in Limpopo, northern South Africa.



**Fig. 7.** Reddish-pink form of *Scadoxus multiflorus* subsp. *multiflorus*.



**Fig. 8.** *Scadoxus multiflorus* subsp. *multiflorus* in habitat, near Ruacana, northwest Ovamboland, Namibia, January 26, 1991. Photograph by Dave Lehmiller.



**Brief description:** Plant extremely variable, fully deciduous, summer-growing, clump-forming, up to 1m high, terrestrial; pseudostem short to long, plain or spotted. *Rootstock* a short, erect rhizome with a bulbous upper part. *Leaves* 2–8, broadly lanceolate or oval, 85–450 x 25–300mm, alternate, shiny light green, margins slightly to strongly undulate, produced together with, or immediately after flowers. *Scape* arising next to pseudostem, 150–550mm long, light green or maroonish-brown speckled towards base. *Flowerhead* spherical, 20–100-flowered, 150–260mm in diam., spathe bracts inconspicuous, light green; pedicels green, 15–35mm long; perianth tube 5–15mm long; tepals linear, 13–30 x 0.6–2.0mm, bright orange-red to scarlet, occasionally pinkish-red. *Filaments* orange-red, well exerted. *Berries* globose, on radiating pedicels, red. (**Fig. 6, 7, 8.**)

**Flowering time:** October-January.

**Distribution and habitat:** The subsp. *multiflorus* is the most variable of the three taxa and has by far the widest distribution of all the scadoxus. It occurs in summer rainfall parts of north-eastern South Africa, northern Botswana and Namibia, and in all countries in Tropical sub-Saharan Africa, Tropical Arabia (Yemen, Oman and Saudi Arabia), and outlying islands including Socotra (Yemen), where a dwarf form occurs, the Gulf of Guinea (Equatorial Guinea) and Inhaca Island (Mozambique). Its habitat is lightly shaded woodland, grassland and bushveld, from the coast to 2700m, in sandy or humus-rich soils, sometimes amongst boulders and on termite mounds.

**Cultivation:** This subspecies is not as easily cultivated as subsp. *katharinae* as it is deciduous and requires a dry winter dormant period. It is best grown in containers and likes a lightly shaded environment and a well drained medium such as equal parts of finely sifted, acid compost and coarse river sand. The inflorescence often appears before the leaves develop.

#### **b. subsp. *katharinae* (Baker) Friis & Nordal**

**Common name:** ‘Blood Lily’

***katharinae*:** after Katharine Saunders (1824-1901), English flower painter and plant collector in KwaZulu-Natal, South Africa.

**Historical notes:** The Kew botanist J.G. Baker described this taxon as *Haemanthus katherinae* Baker in *The Gardeners’ Chronicle* in 1877, from material collected in South Africa by the English artist Katharine Saunders. She found it flowering in a marshy place near the coast, somewhere in

KwaZulu-Natal, in February 1868, and noted it grew to ‘five feet high’. She illustrated it in watercolour and more than a century later her painting appeared in print on Plate 17 of the book *Flower Paintings of Katharine Saunders* (Bayer 1979). Baker erred in his spelling of the specific name, which is correctly *katharinae*.

***Brief description:*** Plant more or less evergreen, up to 1.2m high, terrestrial, clump-forming; pseudostem well developed, light green, plain or reddish-brown spotted. *Rootstock* a short to long, erect, rhizome with a bulbous upper part. *Leaves* 3–8, broadly lanceolate, 250–450 x 75–410mm, spreading, margins slightly to strongly undulate; petioles 50–80mm long. *Scape* arising next to pseudostem, 600–700mm long, light green, plain or heavily reddish-brown spotted. *Flowerhead* spherical, up to 150-flowered, up to 220mm in diam., spathe bracts inconspicuous, greenish; pedicels 25–45mm long, light green; perianth tube 17–22mm long; tepals lanceolate, bright pinkish-red to orange-red, 18–25 x 3–4mm. *Filaments* 30–40mm long, well exerted, red. *Berries* globose, orange to deep red, on radiating pedicels. (**Fig. 9, 10.**)

***Flowering time:*** January–March.



**Fig. 9.** *Scadoxus multiflorus* subsp. *katharinae* from Inhaca Island, Mozambique.





**Fig. 10.** Ripe berries of variegated form of *Scadoxus multiflorus* subsp. *katharinae*.

*Distribution and habitat:* The subsp. *katharinae* is native mainly to the eastern seaboard of South Africa, occurring in the eastern and north-eastern parts of the Eastern Cape and KwaZulu-Natal. It also occurs in inland parts of KwaZulu-Natal, as well as in western Swaziland and on Inhaca Island east of Maputo in southern Mozambique. The plants occur in colonies, in shade of perennially moist coastal or swamp forest. The inflorescences appear well after the new leaves have fully developed.

*Cultivation:* This is one of the most desirable members of the genus. Due to its ease of cultivation in temperate climates, it can be regarded as evergreen as the new leaf shoots appear before the old leaves have withered. It is a spectacular garden and container plant, and can be grown indoors or on a shaded patio in terracotta or plastic containers with a diameter of 30–35cm are recommended, and these need not be deep as the roots spread out horizontally (Duncan, 2001). Variegated forms sometimes appear in cultivation, such as the one illustrated here (**Fig. 10.**), grown by my colleague Monique McQuillan at Kirstenbosch. In ideal conditions, subsp. *katharinae* can flower in its third season from seed, but this usually takes place in the fourth year.

The roots and rhizomes are extremely susceptible to the ‘red blotch’ fungal disease caused by the air-borne fungus *Stagnospora curtisii*, which can be controlled to a certain extent by drenching and spraying with copper oxychloride. Heavily infested plants are best destroyed, but those with mild infections can cope with the condition for many years.

**c. subsp. *longitubus*** (C.H. Wright) Friis & Nordal

*Historical notes:* The plant was originally described as *Haemanthus longitubus* C.H. Wright in the *Journal of the Linnean Society* (Botany) from a specimen collected by A. Whyte in 1904 in southern Liberia’s Sinoe River Basin (Wright, 1905). It was introduced into cultivation at Kew in 1877 from another collection made in Liberia and illustrated on Plate 6364 of *Curtis’s Botanical Magazine* in 1878, from a plant that flowered at Kew that same year, described as *Haemanthus mannii* Baker. The taxon does not appear to be in cultivation any longer.

*Brief description:* *Plant* fully deciduous, summer-growing, up to 650mm high, terrestrial; pseudostem well developed, about 200mm long, heavily spotted. *Rootstock* a short, erect rhizome with a bulbous upper part. *Leaves* 4–6, elliptical, 150–200 x 63.5mm, suberect, bright green, produced

together with or after flowers, petioles 31mm long. *Scape* arising next to pseudostem, about 300mm long, reddish-spotted. *Flowerhead* spherical, 30–40-flowered, up to 125mm in diam., spathe bracts linear, reddish; pedicels bright red, 12–20mm long; tepals linear to narrowly lanceolate, 18–30 x 1.1–3.5mm bright scarlet, tube cylindrical, 16–28mm long.

*Filaments* bright red, slightly exerted.

*Flowering time*: February–April.

The subsp. *longitubus* occurs in West Africa and is recorded from Guinea, Sierra Leone, Liberia, Côte d'Ivoire and Ghana, occurring in forested habitat along river banks and in leaf litter of the forest floor.

*Cultivation*: The plant was successfully cultivated at Kew in the late 1870's and probably has similar requirements to those of subsp. *multiflorus*, namely a lightly shaded environment in a humus-rich, well drained medium, with a dry winter dormant period. Like subsp. *multiflorus*, the inflorescence appears before, or together with the developing leaves.

### ***Scadoxus nutans*** (Friis & Björnstad) Friis & Nordal

***nutans***: nodding, with reference to the orientation of the flowerhead.

*Historical notes*: This curious species from southwestern Ethiopia is a relatively recent discovery, having been described just 32 years ago in the *Norwegian Journal of Botany*, following a Danish Botanical Expedition to Ethiopia when the plants were discovered in flower in November 1970 by I. Friis, A. Hounde and K. Jacobsen (Friis & Björnstad, 1971). A more recent study trip by Jonathan Hutchinson and Melaku Wondafrash provided valuable new information regarding its habitat, and an outstanding colour plate by Christabel King was reproduced in *Curtis's Botanical Magazine* from a plant grown by Brian Mathew in England (Hutchinson & Wondafrash, 2011).

*Brief description*: Plant fully deciduous, up to 1m high, mainly epiphytic, rarely lithophytic or terrestrial, clump-forming; pseudostem well developed, plain or reddish-brown spotted, 300–400mm long. *Rootstock* a short, thick, erect rhizome, producing long stolons from the base. *Leaves* 2–5, narrowly lanceolate, 200–400 x 50–80mm, spreading to arcuate, bright green, margins slightly to strongly undulate, produced together with new leaves. *Scape* arising within pseudostem and rupturing it at base, 100–200mm long, always much shorter than pseudostem, distinctly nodding at apex, becoming erect in fruit, bright green, heavily reddish-brown spotted. *Flowerhead* brush-like,

nodding, 30–50-flowered; spathe bracts obtuse, basally fused, translucent white; pedicels green, 7–12mm long; tepals narrowly lanceolate, 18–0 1.5–2.0mm, reddish orange, deep red or pinkish; tube cylindrical, 7–8mm long. *Filaments* well exerted, 30–35mm long, reddish orange, deep red or pinkish. *Berries* ovoid, on erect pedicels, dark red. (**Fig. 11.**)

*Flowering time*: November–February.

*Distribution and habitat*: This species is endemic to the Kefa Floristic Region in the Kefa and Illubabor provinces in the highlands of southwestern Ethiopia. The plants grow in thick clumps and are mainly epiphytic, growing in evergreen montane forest in humus of tree forks and along branches of several tree species, or occasionally as a lithophyte or in leaf litter of the forest floor, at elevations from 1000–2300m (Hutchinson & Wondafrash, 2011).

*Cultivation*: *Scadoxus nutans* is an interesting species for the specialist grower and performs well in pots in a well aerated, humus-rich growing medium such as composted bark, sphagnum peat moss and coarse grit. When grown in South Africa, its main growth period is from mid-summer to mid-winter, followed by a distinct dormant phase. It requires medium- to heavy shade and cool nights, and performs well with regular watering when in active growth, and just occasional applications when dormant to prevent the fleshy roots from desiccation. The rootstock is susceptible to attack by mealybugs, and the leaves to red spider mites (Hutchinson & Wondafrash, 2011).

### ***Scadoxus pole-evansii* (Oberm.) Friis & Nordal**

**Common names**: ‘Nyanga Fireball’; ‘Pungwe Lily’

***pole-evansii***: after Dr I.B. Pole Evans (1879–1968), Welsh-born South African botanist.

*Historical notes*: This magnificent plant was discovered as recently as December 1962 by R.J. Pole Evans, son of Dr I.B. Pole Evans, while mountaineering in northeastern Zimbabwe. Rhizomes were cultivated at the Pretoria National Botanical Garden in South Africa and the plant was described as *Haemanthus pole-evansii* by Amelia Obermeyer in the botanical journal *Kirkia* (Obermeyer, 1963), followed by an account and colour plate in *The Flowering Plants of Africa* (Obermeyer, 1965).

*Brief description*: *Plant* robust, fully deciduous, partially summer- and winter-growing, up to 1.3m high, mainly terrestrial, rarely epiphytic;





**Fig. 11.** *Scadoxus nutans* from south-western Ethiopia.

pseudostem well developed, heavily magenta-spotted. *Rootstock* a solitary large, short, erect rhizome with a large, heavily magenta-spotted bulbous upper part. *Leaves* 4–6, lanceolate to oblanceolate, 30–45 x 12–16mm, suberect, glossy bright green; margins slightly to strongly undulate; petioles enclosed in a long sheath up to 160mm long. *Scape* arising next to pseudostem, up to 1m long, plain, bright green, appearing just before or simultaneously with new leaves. *Flowerhead* spherical, 50–70-flowered; spathe bracts triangular, translucent light brown, dry; pedicels 35–40mm long, bright green, elongating considerably in fruit; tube narrowly funnel-shaped, 4–7.0 x 3.5mm; tepals broadly lanceolate, 16–18 x 5–7mm, spreading, light to deep salmon-pink or pinkish-red. *Filaments* well exerted, anthers prominent, 6mm long. *Berries* globose, deep cherry-red, on long pendent pedicels. (Fig. 12, 13.)

*Flowering time*: December–February

*Distribution and habitat*: *Scadoxus pole-evansii* is endemic to a very narrow range in the Nyanga Mountains in the eastern highlands of Zimbabwe, where it is known from only a few sites between 1500–2000m. The plants grow in colonies in dense shade of moist evergreen forest and are found in leaf mould, mainly on the forest floor, but also in humus-filled forks of trees. The seeds are spread by vervet and samango monkeys and by birds including green louries (Clarke, 1991).

*Cultivation*: Perhaps the most spectacular scadoxus of all, this plant is an outstanding subject for large containers in the heated greenhouse in cold climates, or for shady patios and beneath evergreen trees in frost-free gardens. Apart from the showy flowerhead, the plant is worth growing for its attractively magenta-spotted pseudostem and basal leaf sheaths alone (Fig. 13.). It likes a humus-rich, well drained medium such as equal parts of composted bark, peatmoss and coarse grit, and as much as half of the rootstock can be left exposed. The plants are fully deciduous and partially summer- and winter-growing; they have a very different growth cycle in comparison with forms of the summer-growing *S. multiflorus* subsp. *multiflorus* and *S. puniceus* from South Africa, in that they enter dormancy in late spring and early summer and only begins active growth in late summer, and remain green until late winter.

***Scadoxus pseudocaulus*** (Björnstad & Friis) Friis & Nordal  
*pseudocaulus*: descriptive of the prominent false stem.



**Fig. 12.** *Scadoxus pole-evansii* from north-eastern Zimbabwe.



**Fig. 13.** Spotted basal leaf sheaths of *Scadoxus pole-evansii* from north-eastern Zimbabwe.



**Historical notes:** The type material was collected by P.W. Richards in April 1935 near sea level in the Shasha Forest Reserve in Ijebu Province in southwestern Nigeria. The plant was originally described as *Haemanthus pseudocaulus* Björnstad & Friis in the *Norwegian Journal of Botany* (Björnstad & Friis, 1972b) and in the same publication, *H. pseudocaulus* subsp. *prorumpens* Björnstad & Friis was described from a collection made by R.W. Keay in May 1957 in Benin Province in western Nigeria. The subsp. *prorumpens* was based on specimens in which the scape ruptures the pseudostem near its base and breaks through laterally, unlike subsp. *pseudocaulus* in which the scape appears between the leaves at the top of the pseudostem. This character was later determined to be inconstant, but dependent on variation in external factors, and subsp. *prorumpens* was consequently placed in synonymy (Friis & Nordal, 1976). An excellent line drawing of *Scadoxus pseudocaulus* depicting the two different modes of scape emergence was published on Plate 2 of a chapter on Amaryllidaceae in *Flore du Cameroun* (Nordal, 1987).

**Brief description:** Plant more or less evergreen, summer-growing, up to 800mm high, terrestrial; pseudostem well developed, 150–450mm long, light green. *Rootstock* a very short, erect rhizome. *Leaves* 4, broadly lanceolate, 150–450 x 50–120mm, suberect, light green; petioles 40–50mm long, light green. *Scape* 300–650mm long, arising within pseudostem, rupturing base and appearing laterally, or appearing between leaves, purplish. *Flowerhead* spherical, 20–50-flowered; spathe bracts lanceolate, white tinged with pink, ephemeral; pedicels 15–25mm long, light green, lengthening in fruit; tube cylindrical, 10–18mm long; tepals narrowly lanceolate, 12–26 x 2.0–4.5mm, brick red. *Filaments* shortly to well exerted, brick red; pollen yellow. *Berries* globose, orange-red, on pendent pedicels.

**Flowering time:** April-May

**Distribution and habitat:** *Scadoxus pseudocaulus* is native to West Africa, occurring in Nigeria, Cameroon, Equatorial Guinea and Gabon. It occurs in lowland evergreen forest near sea level in Nigeria, and in Cameroon it is rare and limited to the western part in forests below Mt. Cameroon, up to 1700m (Nordal, 1987).

**Cultivation:** This species is rare in cultivation but is easily grown in a well drained, humus-rich medium such as equal parts of composted bark, peatmoss and coarse grit, in light shade. Its medium stature with purplish scape and leaf sheaths, and brick red flowerhead, renders it suitable for

container cultivation in the greenhouse in cold parts and on the patio in temperate climates. It is more or less evergreen, the new leaf shoots appearing before the old leaves have withered.

***Scadoxus puniceus* (L.) Friis & Nordal**

**Common names:** ‘Blood Lily’, ‘Snake Lily’

***puniceus*:** scarlet, carmine or crimson, with reference to the reddish-orange flowers.

***Historical notes:*** Carolus Linnaeus was the first to provide this plant with a binomial, which he published as *Haemanthus puniceus* L. in Volume 1 of his *Species Plantarum* in 1753. The plants most often illustrated in early paintings depict robust forms with long, prominent pseudostems and large flowerheads, but one of the earliest illustrations is that of J. Moninckx on Plate 77 (Vol. 8) of his *Moninckx Atlas*, also known as *Horti Medici Amstelodamensis Rariorum Plantarum Descriptio et Icones*, which depicts a form with a short pseudostem and relatively small flowerhead, grown in the Amsterdam *Medicus Hortus*. The Moninckx volumes were published from 1682-1709 and are housed in the University of Amsterdam Library; Linnaeus is thought to have relied substantially on the paintings and information in these volumes for the compilation of his *Species Plantarum* and may have based his very short description of *H. puniceus* on this painting.

*Scadoxus puniceus* was illustrated numerous times in paintings of the early to mid 19<sup>th</sup> Century and described under *Haemanthus* by various authors; among the most familiar names are *H. magnificus* (Herb.) Herb. and *H. natalensis* Pappe ex Hook. which have been used to identify two of the more robust forms of the species, which now form part of an extensive list of synonymy.

***Brief description:*** *Plant* extremely variable, fully deciduous, summer-growing, up to 1m high, terrestrial; pseudostem short to long, heavily reddish-brown spotted, up to 500mm long. *Rootstock* a short rhizome with a large bulbous upper part. *Leaves* 2–12, alternate, blade broadly lanceolate to ovate, 140–300 x 58–120mm, spreading to suberect, glossy, light green, produced together with flowers or shortly afterwards; margins slightly to strongly undulate. *Scape* 150–900mm long, arising next to pseudostem, light green, plain or heavily reddish-brown-spotted at base. *Flowerhead* brush-like, very many-flowered, spathe bracts lanceolate to ovate, free, translucent green to glossy reddish brown, shorter than, as long as, or



**Fig. 14.** Robust form of *Scadoxus puniceus* with reddish-brown spathe bracts.



**Fig. 15.** Robust form of *Scadoxus puniceus* with greenish spathe bracts.





**Fig. 16.** *Scadoxus puniceus* as a container subject.

longer than flowers, persistent; pedicels 20–30mm long, light green; tube cylindrical, white, 3–12mm long; tepals linear, 20–25mm long, orange or reddish-orange, rarely white or yellow. *Filaments* shortly exserted. *Berries* globose, on erect pedicels, dark red. (Fig. 14, 15, 16.)

Flowering time: August–March.

Distribution and habitat: *Scadoxus puniceus* is the most widespread of the three species which occur in southern Africa. Its distribution extends from South Africa to Tanzania, with extraordinary disjunct populations in Ethiopia; it is native to the southern, eastern and northern parts of South Africa from Bredasdorp near the southern Cape coast to Limpopo Province, including Lesotho and Swaziland, to Botswana, Zimbabwe, Mozambique, Zambia, Tanzania, Malawi and Ethiopia. Its habitat is very varied in full sun and lightly shaded conditions, from the coast to 2100m, in subtropical thicket, grassland and bushveld, in sandy and heavy soils with a fairly high humus content.

Cultivation: Theoretically, the many different forms of this extremely variable plant provide the *Scadoxus* enthusiast with the opportunity to have the species in flower for as long as seven months, from early spring to early autumn (August to March). A rare white-flowered form has been known in cultivation for a number of years and the appearance of Herbert Kelly's yellow form 'Yellow Splendour', described elsewhere in this volume, is an exciting new development.

The plants are not very particular as to soil type, as long as it drains well and contains some organic matter, and they perform very well in containers as well as in frost-free garden beds. Dappled shade is preferred by most forms, and this is the most sun-tolerant of all the species. Once established, the plants can be left undisturbed for ten years or more. Depending on the form, the inflorescence may appear before the leaves, or develop simultaneously, or appear at any time during the summer active growth period. In suitable conditions, this plant is very long-lived. A case in point is a mature plant of a robust form I obtained in 1977 from the former Bloem-Erf wildflower nursery near Stellenbosch, which would have been at least five years old at the time, which has flowered every subsequent spring, and shows no sign of loss of vigour in 2012, now some 40 years old.

The plant reproduces readily by offset formation and is easily raised from seed. Seedlings often fail to produce a leaf during the first year, expending all their energy in the production of the young rootstock.

In southern Africa, the thin-textured leaves, scape and pseudostem are extremely susceptible to attack by caterpillars of the lily borer, *Brithys pancratii*, which can be treated with a natural spray containing natural pyrethrins, or alternatively with an insecticide containing carbaryl, in heavy infestations.

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KEY TO THE TAXA OF *SCADOXUS*

- 1a Pseudostem well developed (200mm long or more) .....2
- 1b Pseudostem absent or relatively short (up to 100mm long) .....9
- 2a Flowerhead brush-like, pedicels erect or nodding .....3
- 2b Flowerhead more or less spherical; pedicels radiating or arcuate .....4
- 3a Flowers nodding; spathe bracts partially fused, inconspicuous, translucent white, short-lived; south-western Ethiopia..... *S. nutans*
- 3b Flowers erect to slightly spreading; spathe bracts free, prominent, shiny reddish brown or greenish, persistent; robust forms; eastern and northern South Africa to Tanzania; disjunct populations in Ethiopia.....*S. puniceus*
- 4a Tepals lanceolate to broadly lanceolate (12–20 x 4–7mm); perianth tube narrowly funnel-shaped.....5
- 4b Tepals linear to narrowly lanceolate (12–30mm x 0.6–4.5mm); perianth tube cylindrica .....6
- 5a Pedicels radiating; perianth tube 4–7mm long; perianth erect to spreading; tepals salmon-pink to pinkish-red; north-eastern Zimbabwe..... *S. pole-evansii*
- 5b Pedicels arcuate; perianth tube 30–40mm long; perianth pendent; tepals scarlet; eastern Democratic Republic of Congo to western Uganda ..... *S. cyrtanthiflorus*
- 6a Scape initiated within pseudostem, appearing between leaves or rupturing pseudostem at base and breaking through; perianth tube 10–18mm long; Nigeria to Gabon ..... *S. pseudocaulus*
- 6b Scape initiated outside pseudostem; perianth tube 16mm long or more.....7
- 7a Plants evergreen, robust (up to 1.2m high); flowering simultaneously with fully developed leaves; perianth tube 17–22mm long; eastern South Africa to Inhaca Island (Mozambique).....*S. multiflorus* subsp. *katharinae*
- 7b Plants deciduous, medium-sized (up to 1m high), flowering before leaves appear or have fully developed; perianth tube 5–28mm .....8
- 8a Perianth tube 16–28mm long; Guinea to Ghana..... *S. multiflorus* subsp. *longitubus*
- 8b Perianth tube 5–15mm long; widespread in southern and Tropical Africa and Tropical Arabia ..... *S. multiflorus* subsp. *multiflorus*
- 9a Leaves narrowly lanceolate, (400 x 20mm); perianth tube 0.8mm long; Democratic Republic of Congo ..... *S. longifolius*

- 9b Leaves broadly lanceolate or oval (100–230 x 30–90mm); perianth tube 3–10mm long..... 10
- 10a Flowerhead brush-like; spathe bracts prominent, persistent, shiny reddish- or greenish-brown ..... 11
- 10b Flowerhead spherical; spathe bracts inconspicuous, ephemeral, greenish white ..... 12
- 11a Spathe bracts 4–5, shiny reddish brown, apices equal to or overtopping flowers; perianth tube 3–7mm long; pseudostem absent; Eastern Cape and KwaZulu-Natal, South Africa..... *S. membranaceus*
- 11b Spathe bracts 5–11, brownish green, apices shorter than flowers; perianth perianth tube 3–12mm long, pseudostem present; dwarf forms, southern and eastern South Africa.....*S. puniceus*
- 12a Petioles 100–320mm long, arising directly from rhizome (pseudostem absent); perianth tube 3–10mm long; plants evergreen; Sierra Leone to Angola ..... *S. cinnabarinus*
- 12b Petioles up to 30mm long, arising from pseudostem; perianth tube 5–15mm long; plants deciduous, dwarf to medium-sized forms; widespread in southern and Tropical Africa, and Tropical Arabia..... *S. multiflorus* subsp. *multiflorus*

## SCADOXUS PUNICEUS 'YELLOW SPLENDOUR'

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### SCADOXUS PUNICEUS FORMS

*Scadoxus puniceus* is found in Africa. The name 'Scadoxus' is derived from 'dokus' meaning glory or splendour, and 'puniceus' means crimson, scarlet or purple. Common names are Paintbrush Lily, Shaving Brush Flower, Snake Lily and Royal Lily. It is a member of the Amaryllidaceae family. It was first botanically described by Linnaeus as *Haemanthus puniceus* in 1753 (Sp. Pl. p. 325/1753). *Haemanthus natalensis* and *Haemanthus magnificus* were at one time called separate species, but both names were transferred to *Scadoxus puniceus* by Friis & Nordal in 1976. These latter two forms of *Scadoxus puniceus* are currently being distributed in the horticultural trade as *Scadoxus puniceus* 'Natalensis' and *Scadoxus puniceus* 'Magnificus'.

*Scadoxus puniceus* enjoys morning sun to afternoon shade in California. It also performs well in full hot sun. It does equally well as a pot plant or when planted in the ground. It requires a well draining mix with generous amounts of organic matter, and it appreciates copious watering during the hot summer months. Keep it dry during winter months as plants need a winter rest. Resume watering when signs of growth re-appear.

Leaves are glossy green and have wavy margins. The large fleshy leaves follow after flowering and die off in winter. I have seen many clumps in California which are over 20 years old that are up to four feet in diameter. They are breathtaking when in bloom. Plants do not appreciate being disturbed once established.

All parts of the plant are toxic. Plants are quite hardy in California. Plants flower from approximately spring to early summer. Flowers have a shaving brush appearance, hence the name Shaving Brush Flower.

*Scadoxus puniceus* appears in two distinct forms, one with a green scape and green spathe bracts (Fig. 1), and the other with a green scape and brownish-maroon-red spathe bracts which envelope the beautiful orangish-carmine-colored blossom (Fig. 2). Flower stalks appear separately before the leaves emerge, and they are green in color. Newly emerging

scapes of *Scadoxus puniceus* are quite colorful (Fig. 3). Each bulb produces one flowering scape per year. Orangish scarlet flowers are the normal color. Figure 4 shows *Scadoxus puniceus* in full bloom. Seeds (Fig. 5) require 4 to 5 years to flower after sowing. Anthers extend beyond the flower tube and are yellow when mature. Flowers have no fragrance. Leaf bases are pale green with maroon speckles or spots.

#### SCADOXUS PUNICEUS ‘YELLOW SPLENDOUR’

The very rare form of *Scadoxus puniceus* ‘Yellow Splendour’ was obtained from a seed originating from a regular orangish-carmine-colored form which was collected in Natal, South Africa almost 25 years ago by noted plant explorer and friend, Gary Hammer. Throughout the many years of growing seed from this original field-collected plant and its offspring, only this one butter-yellow flower-form occurred. When I discovered this rare botanical treasure, it had endured many years of neglect – years without regular watering, almost void of soil covering its roots, leaves almost non existent, infested with mealy bugs, overgrown with weeds, etc. After correcting all these deficiencies the plant started to grow, showing its appreciation. The bloom shown (Fig. 6) is the result of the neglect the plant received – it is a small token bloom. The plant should regain all of its normal growth and flower size in the next season with the care it is currently receiving,

My bulb of ‘Yellow Splendour’ is now 7 years old. It sports both dark brownish-maroon-red spathe bracts and scape (Fig. 7, 8), which is probably the result of a recessive gene. It is a spectacular color combination between the scape-spathe bracts and the striking butter-yellow flower, and it is a sight to behold when in bloom.

I also have obtained a white form, named *Scadoxus puniceus* ‘Snow Flurry’ (Fig. 9), that originated via seed from the same field-collected plant which gave forth *Scadoxus puniceus* ‘Yellow Splendour’. This white cultivar possesses a green scape and reddish-brown spathe bracts.

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**Fig. 1.** *Scadoxus puniceus* showing a green scape and green spathe bracts. (Photo by Ken Blackford)



**Fig. 2.** *Scadoxus puniceus* showing a green scape and brownish-maroon-red spathe bracts. (Photo by Ken Blackford)



**Fig. 3.** *Scadoxus puniceus* showing a newly emerging scape. (Photo by Ken Blackford)





**Fig. 4.** *Scadoxus puniceus* in full bloom. (Photo by Ken Blackford)

**Fig. 5.** *Scodoxus puniceus* showing ripening fruit. (Photo by Ken Blackford)







**Fig. 6.** *Scadoxus puniceus* 'Yellow Splendour' beginning to bloom. Note both the dark brownish-maroon-red spathe bracts and scape. (Photo by Herbert Kelly Jr.)



**Fig. 7.** The scape of *Scadoxus puniceus* 'Yellow Splendour' has increased in height from the preceding image. (Photo by Herbert Kelly Jr.)



**Fig. 8.** The spathe bracts of *Scadoxus puniceus* "Yellow Splendour" are almost fully opened. (Photo by Herbert Kelly Jr.)





**Fig. 9.** *Scadoxus puniceus* 'Snow Flurry'. (Photo by Herbert Kelly Jr.)

## COASTAL BULBS OF ISRAEL

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### INTRODUCTION

The coastal plain of Israel follows the Mediterranean shores from Lebanon in the north to Gaza Strip and Egypt in the south. It is narrow in the north and becomes wider as one goes south. It is split into the Coast of Galilee, the Coast of Carmel, Sharon and Pleshet.

The main geological characters of this region are the sands layered from the sea and, on the other hand, by the alluvial soils driven from the mountain ridges by rivers and washes. The sands originate in the Ethiopian highlands of East Africa; they are driven by the Nile River to the Mediterranean and there by the east Mediterranean currents to the coasts of Israel. Fresh sand forms mobile sterile dunes on the coast which are slowly inhabited by *Stipagrostis scoparia* (a perennial grass), and then through a succession process become dominated by *Artemisia monosperma* shrublets and later by a climax vegetation of a *Retama raetam* shrubbery. Ancient coastal dunes were calcified into sandstone ridges, three of which occur along and parallel to the present shoreline. This local calcified sandstone (kurkar) is the only coastal native rock. Another form of ancient sand is hamra sandy loam, a reddish sandy-clayish soil. The rivers and washes streaming westwards from the Samarian and Judean mountains were stuck in ancient times by the kurkar sandstone ridges, inundating plains and forming swamps and seasonal muddy habitats.

Most of the habitats formed by the geological history and other factors are home to many geophytes, some of which are endemic and extremely rare. Most of these geophytes are described and illustrated in *Flora Palaestina* (Feinbrun, 1986) and listed in later publications (Fragman et al., 1999). In the sandstone, geophytes dominate rock crevices and can reach a density of 3000 plants per 1000m<sup>2</sup> and more. Most endemic plant species occur along the whole plain as well as the coasts of northern Sinai in Egypt and the southern Lebanese coasts in the north. Phyto-geographically, the



flora is predominantly Mediterranean (average annual precipitation is 500-600mm), but interestingly many Saharo-Arabian (desert) elements have migrated northwards along the sandy habitats and have survived here in proper Mediterranean climate zone. The sandier the habitat is, the more arid and desert origin its flora becomes. The southern areas of the coastal plain become arid and average annual precipitation drops to 300-400mm. This is the edge of the transition belt between the Mediterranean and the desert. Here one can find some Irano-Turanian species as well as Mediterranean and desert ones. The arid desert geophytes of Israel were previously presented in *Herbertia* (Fragman-Sapir, 2010).

#### **CONSERVATION AND DISTURBANCE**

The coastal plain is the most inhabited region in Israel. The Tel-Aviv metropolis has expanded and is now almost touching smaller towns and villages in the northeast and south. Natural habitats have suffered in the past 80 years and remain today as islands in developed areas. The main threats are urbanization, industrial and agricultural expansions. The Mediterranean coasts are suffering from dense tourism as well. Since the remaining natural habitats are small, they are all affected by their disturbed adjacent regions, whether it is agricultural pesticides, invasive plants or too many bikes and jeeps. The local flora in many places is almost gone. The botanical gardens of Israel play an important role in EX-SITU conservation of endangered plants. At the Jerusalem Botanical Gardens an “Adopt A Plant” project has been successful and funds from private people and companies have been collected to save more than 200 nationally endangered species.

#### **COSTAL BULBS OF ISRAEL**

Almost all the coastal geophytes of Israel are detailed here in text, mostly in pictures as well. All pictures were taken in nature during the last 25 years. The basic knowledge on the region's bulbs was based on *Flora Palaestina* (Feinbrun, 1986). Additional information was gathered in the field during private botanical excursions and other field trips organized by “Rotem” - Israel Plant Information Centre, the Society for the Protection of Nature in Israel, Israel Nature and Parks Authority and the Jerusalem Botanical Gardens. Plant families are listed alphabetically.

**Alliaceae (Fig. 1-9)**

*Allium tel-avivense* is a symbol of the endemic coastal flora of Israel. It has a stout scape and a dense pale pink flowering head. It is a frequent plant of hamra and stabilized sands. In many cases it forms large stands although it has little vegetative reproduction rates. *Allium erdelii* and a new related taxon have creamy flowers and bloom in kurkar sandstone in March. Their relative, the white flowered *A. neapolitanum*, is found in disturbed, often partly shady places. In early summer one can find the impressive *Allium ampeloprasum* and *Allium curtum* ssp. *curtum*. The rare, endangered and impressive *Allium schubertii* became extinct in the Sharon, but it remained in a few sites in Pleshet in edges of agriculture land and within planted eucalyptus groves. It is a tumble weed restricted to deep alluvial soils. The newly described *A. israeliticum* (Fragman-Sapir & Frisch, 2011) is rare in the coast, found in disjunctive populations in Coast of Carmel, but commoner in Pleshet.

**Amaryllidaceae (Fig. 10)**

All amaryllids of Israel are listed and illustrated in Herbertia 62 (Fragman-Sapir, 2007). *Pancratium maritimum* is the only bulb of the coastline; it begins blooming already in July but will peak in September. In kurkar sandstones *Vagaría parviflora* is common blooming in late September-early October. *Narcissus serotinus* is restricted to the rocky Coast of Carmel where locally it is abundant; it is almost extinct in the northern Sharon. *Narcissus tazetta* has become rare; it is restricted to winter inundate fields.

**Araceae (Fig. 11-14)**

*Biarum angustatum* is a hystranthous tuberous plant that blooms in October. It is rather rare, found in kurkar sandstones. *Arum hygrophyllum* and *Arisarum vulgare* are common in semi-shade dump habitats.

**Asphodelaceae (Fig. 15-16)**

*Asphodelus aestivus* is more common in the southern grazed areas, where it is often dominating hills and plains. The common coastal asphodel is the annual *Asphodelus tenuifolius* that inhabits sandstone crevices.

**Berberidaceae**

*Leontice leontopetalum* is widespread only in the southern parts of the

region and becomes even commoner in the semi-desert (Fragman-Sapir, 2010).

### **Colchicaceae (Fig. 17-18)**

*Colchicum stevenii* is common in sandstone ridges and hamra sandy loam. It is sub-hysteranthous, blooming only after the strong November rains, and it often forms small but charming little pink carpets.

### **Hyacinthaceae (Fig. 19-21)**

*Leopoldia bicolor* is a coastal endemic; it has blackish perianth segments and a rather shy sterile flag at scape top. This is in contrast to the commoner inland *Leopoldia comosa*. *Bellevalia trifoliata* is rare in the Sharon but has remained in the southern part - Pleshet. *Muscari parviflorum* is a shy but beautiful autumnal bulb; it grows in deep alluvial soils as well as in sandstone, blooming just after the first strong rains in November. *Scilla autumnalis* is one of the commonest bulbs of all Israel; in the coast it is found mainly in sandstone. In kurkar sandstone *Scilla hyacinthoides* forms large stands and showy violet displays in March. *Drimia maritima* is common in diverse habitats; it is amazing to see how adaptable it is in different soils from sands and sandy loam to rocky habitats with darker soils. Interestingly, the semi-desert species *Drimia undata* was recently found in the southern coastal areas.

### **Iridaceae (Fig. 22-28)**

*Crocus aleppicus* is a rare endangered plant in the coast (Shmida et al., 2011); it occurs only in coastal Carmel (Shmida et al., 2011). This taxon shows intermediate features between proper *Crocus aleppicus* that occurs in Israel in the volcanic soils of the eastern Galilee and Golan Heights and the Cypriot *Crocus veneris*. Further research is needed in order to identify these populations. The commonest crocus in Israel, the black anthered *C. hyemalis*, is sparse in kurkar sandstone, and it is much commoner inland. Sadly, the once common *Gladiolus italicus* had become rare in the coastal plain, though remaining a common plant inland.

*Iris palaestina* is a frequent species in Israel; although found inland in the Judean foothills, it is particularly common in coastal kurkar sandstone ridges. This interesting bulb is one of two Juno irises that are really Mediterranean and not Irano-Turanian. It has a rather small bulb and perennial storing roots. *Iris grant-duffii* is almost extinct in the coast

(Shmida et al., 2011); this endangered species had a spiny rhizome and beautiful pale yellow flowers. It blooms in February and grows in winter inundated fields. The most impressive coastal iris and a symbol of nature preservation is definitely the endemic *Iris atropurpurea*. This *Oncocylus* iris used to be commoner and now remains in disjunctive populations between Ashdod and Hadera. *Moraea sisyrinchium* is also common, one of the commonest bulbs of the whole country. *Romulea bulbocodium* is a scarce winter flower, found in winter-dump hamra sandy loam.

### **Liliaceae (Fig. 29-31)**

In March one cannot ignore the wonderful bloom of *Tulipa agenensis* ssp. *sharonensis*. It occurs in hamra sandy loam as well as in kurkar sandstone. This ssp. has short scapes and strongly undulate leaves. In shade places one can find taller plants that are identical to the typical ssp. occurring inland.

*Gagea dayana* is a small, endemic and endangered bulb (Shmida et al., 2011). It has a typical bulb that is covered by arched thick roots. The species was recently separated from its desert vicariant *G. circumplexa* (Zarrei et al., 2009). *Gagea commutata* is commoner, occurring in diverse habitats.

### **Orchidaceae (Fig. 32-38)**

Several tuberous Mediterranean orchids occur in the coastal plain. The most prominent are listed here. *Ophrys umbilicata* in the broad sense is very common in kurkar sandstones; it is a variable species with several local varieties, often treated as separate species: *O. latilabris*, *O. flavomarginata*, *O. attica*, *O. carmeli* (Shifman, 2011). In the southern coastal plain (Pleshet) it is the southernmost Mediterranean orchid together with *Orchis collina* (= *Anacamptis collina*). Other common orchids that are sparse in the coastal region are *Orchis papilionacea* ssp. *palaestina* (= *Anacamptis papilionacea* ssp. *palaestina*), *Orchis tridentata* (= *Neotinea tridentata*) and *Ophrys lutea*. In heavy alluvial soils of the Sharon one can find the last remains of the rare and locally endangered (Shmida et al., 2011) *Orchis laxiflora* (= *Anacamptis laxiflora* ssp. *dinsmorei*). *Orchis israelitica*, common in the Galilee, was found in the coastal only once - in Liman Nature Reserve not far from the Lebanese border. *Orchis sancta* (= *Anacamptis sancta*) was once fairly common in hamra sandy loams, but it became rare due to urban expansions. This orchid blooms in April, when



its leaves are already dry and all other orchid species are long gone. The peculiar *Serapias orientalis* is very common in hamra sandy loam.

### **Ophioglossaceae (Fig. 39)**

*Ophioglossum lusitanicum* is a tiny fern with a thick rootstock; it is actually a tiny geophyte, though not often treated as such. In Israel it is extremely rare and endangered (Shmida et al., 2011), restricted to kurkar sandstone.

### **Primulaceae**

*Cyclamen persicum* is the national flower of Israel; it is very common throughout the Mediterranean zone including the coastal plain. Locally it is to be found in kurkar sandstone and rarely in sands under white broom (*Retama raetam*) shrubs.

### **Ranunculaceae (Fig. 40)**

*Anemone coronaria* is one of the earliest geophytes to bloom in the region; it begins blooming in January, peaking in February, when amazing red carpets are formed especially in Pleshet in arid grazed lands. *Ranunculus asiaticus* replaces the anemones in March, but they do not form carpets in the coastal region. Both species are very common also inland in the mountain ridge and both penetrate the semi-desert.

### **CONCLUSIONS**

The geophytic flora of coastal Israel is prominent in its habitats. Local speciation gave birth to some endemic species and subspecies. Additional research will provide knowledge on physiological and morphological adaptations that will be of interest to ecologists, botanists and horticulturists. Several of the showy species are of great potential to water-wise agriculture (Avishai et al., 2005) that becomes so important in the years when precipitation decreases and water prices soar. Modern taxonomic research is needed in many of these geophytes in order to approve their status and to understand their relations with related taxa.

It is my hope that this article will tempt the readers to come and visit our lovely coastal plain and the Jerusalem Botanical Gardens where some of these species and many others grow.

## RECOMMENDED SITES

There are hundreds of interesting sites along this region. I have listed some of the more impressive ones. Large collections of coastal bulbs can be seen at the Jerusalem Botanical Gardens and the Tel-Aviv University Botanical Gardens. The Friends of the Jerusalem Botanical Gardens are organizing monthly day trips to some of the sites below, as well as to other places throughout the country. For more information please visit our website at <http://en.botanic.co.il>.

- Nahal Taninim in coastal Carmel - kurkar ridges here are home to *Vagaria parviflora* in October, carpets of *Narcissus serotinus* blooming with *Colchicum stevenii*, *Scilla autumnalis* and a rare form of *Crocus aleppicus* in late November, followed by *Iris palaestina* in December-January. *Cyclamen persicum* will bloom here in masses in January-February.
- Poleg Reserve south of the town of Natanya - a large reserve with most geological formations of the coast. The sandy areas are home to *Iris atropurpurea*, *Tulipa agenensis* ssp. *sharonensis*, *Allium curtum* ssp. *curtum* and *Allium erdelii*. Sandstone ridges are full of typical Mediterranean species such as *Cyclamen persicum*, *Allium neapolitanum*, *Scilla hiraconthoides* and *Iris palaestina*. Best time to visit – February-March
- Ayalon Highway fields in the north of Tel-Aviv - a bit complicated to find the entering trail, but worth the trouble in January when a muddy wheat field in the northwest part of the busy highway is full of *Narcissus tazetta* in full bloom.
- Humra Hill on the road to Palmachim, south of Tel-Aviv - a hamra sandy loamed hill with dense clumps of *Iris atropurpurea*, *Tulipa agenensis* ssp. *sharonensis*, *Allium tel-avivense* and carpets of annuals. Best time to visit – February to early March.
- Ashdod Acacia Reserve at the north entrance to Ashdod - a sandy area dominated by rare *Feidherbia* (*Acacia*) *albida* thickets. In opening one can find dense populations of *Allium tel-avivense* as well as clumps of *Iris atropurpurea* and *Leopoldia bicolor*. Best time to visit – February to early March.
- Kiriat Gat Junction west of the town of Kiriat gat. Deep alluvial soils are home to the rare and endangered *Allium schubertii* blooming in April.

- Beeri reserve north of the village of Be'eri - a small crater with carpets of red *Anemone coronaria*, *Iris palaestina*, *Asphodelus aestivus*, *Allium israeliticum* and many other flowers. Don't miss neighboring Shokeda area, where anemone carpets are even more intense due to heavier grazing; in February there is an endless red carpet. Avoid crowded weekends; it is a place of pilgrimage for nature lovers.

### **All photographs by the author except where indicated**

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**Fig. 1.** *Allium tel-avivense*, Ashdod Acacia Reserve, 17 March 2012.





**Fig. 2.** *Allium tel-avivense*, Ashdod Acacia Reserve, 17 March 2012.



**Fig. 3.** *Allium neapolitanum*, Plugot Junction, 17 March 2009.



**Fig. 4.** *Allium ampeloprasum*, Jerusalem Botanical Gardens, 24 May 2005.





**Fig. 5.** *Allium curtum* ssp. *curtum*, Tel Hashomer, 1 May 2009. (Photo by Daniel L. Levy)





**Fig. 6.** *Allium schubertii*, south of Plugot Junction, 5 April 2012.



**Fig. 7.** *Allium schubertii*, south of Plugot Junction, 5 April 2012.



**Fig. 8.** *Allium schubertii*, south of Plugot Junction, 5 April 2012.





**Fig. 9.** *Allium* species, Amir Paz Garden, 4 May 2012.



**Fig. 10.** *Vagaria parviflora*, Jerusalem Botanical Gardens, 2 October 2011.



**Fig. 11.** *Biarum angustatum*, Or Akiva, 2 November 2012.  
(Photo by Oz Golan)



**Fig. 12.** *Biarum angustatum*, Or Akiva, 2 November 2012.  
(Photo by Oz Golan)





**Fig. 13.** *Arum hygrophyllum*, Ramat Hasharon, 22 February 2008.



**Fig. 14.** *Arisarum vulgare*, Ramat Hasharon, 22 February 2008.



**Fig. 15.** *Asphodelus aestivus*, Beeri Reserve, 20 February 2004.





**Fig. 16.** *Asphodelus tenuifolius* and *Drimia undata*, west of Yavne, 23 February 2009.





**Fig. 17.** *Colchicum stevenii*, Gisir A-Zarka, 23 November 2011. (Photo by Lior Almagor)



**Fig. 18.** *Colchicum stevenii*, Gisir A-Zarka, 23 November 2011. (Photo by Lior Almagor)



**Fig. 19.** *Leopoldia bicolor*, Tlamim, 5 April 2012.



**Fig. 20.** *Muscari parviflorum*, Jerusalem Botanical Gardens, 28 November 2011.





**Fig. 21.** *Scilla hyacinthoides*, Poleg Reserve, 19 March 2008.





**Fig. 22.** *Crocus aleppicus*, Ma'agan Michael, November 1998.



**Fig. 23.** *Iris palaestina*, Hadassim, 27 January 2009. (Photo by Lior Almagor)



**Fig. 24.** *Iris grant-duffii*, Jerusalem Botanical Gardens, 20 February 2006.





**Fig. 25.** *Iris atropurpurea* and *Allium tel-avivense*, Kadima Reserve, 19 February 2009.





**Fig. 26.** *Iris atropurpurea* and *Allium tel-avivense*, Kadima Reserve, 19 February 2009.



**Fig. 27.** *Iris atropurpurea*, Humra Hill, 29 February 2008.



**Fig. 28.** *Iris atropurpurea*, Humra Hill, 29 February 2008.



**Fig. 29.** *Tulipa agenensis* ssp. *sharonensis*, Rishpon, 7 March 2003.



**Fig. 30.** *Tulipa agenensis* ssp. *sharonensis*, by Ruth Kopel, courtesy of the National Herbarium at the Hebrew University of Jerusalem







**Fig. 31.** *Gagea dayana*, 16 January 2011. (Photo by Yuval Sapir)



**Fig. 32.** *Ophrys latilabris*, Poleg Reserve, 3 March 2010.





**Fig. 33.** *Ophrys umbilicata* ssp. *beerii*, Bitronot Ruhama, 14 February 2002.



**Fig. 34.** *Ophrys umbilicata* ssp. *beerii*, Bitronot Ruhama, 14 February 2002.





**Fig. 35.** *Orchis laxiflora*, Binyamina Meadow, 19 March 2008.



**Fig. 36.** *Orchis laxiflora*, Binyamina Meadow, 19 March 2008.



**Fig. 37.** *Serapias orientalis*, Natanya, 14 April 2011.





**Fig. 38.** *Orchis sancta*, Jerusalem Botanical Gardens, 11 April 2005.





**Fig. 39.** *Ophioglossum lusitanicum*, Bnei Zion, 20 November 2006.



**Fig. 40.** *Anemone coronaria*, Beeri, 6 March 2008.

## CULTIVATION OF *HIPPEASTRUM ANGUSTIFOLIUM* AND *HIPPEASTRUM HARRISONII*

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### FIELD TRIP TO PARAGUAY

From September to October of 1992, I had the opportunity to visit Paraguay for 2 weeks for the purpose of a field study. My specialty was *Tillandsia* (epiphytes or ‘air plants’), but I was also interested in cacti, orchids, etc. I wanted to observe them in the field in their natural condition. But it was a very difficult undertaking for us, because major portions of this country had become devoted to stock farming, and the annual practice of burning the landscape in the spring in advance of new grass was a serious detriment to the rich endemic vegetation. We drove from Asuncion to Iguazú Falls and to Deep Chaco near the Bolivian frontier, almost 3000km in total, but we could find only a few plants that I wished to study. A five hundred year history of annual burning had resulted in Paraguay losing so many precious plants which we could find abundantly only in the book of *Flora Brasiliensis*.

One day as we drove to Tobati from Caacupe (a suburb of Asuncion), we noticed something red and lavender from the roadside in a distant bog place (Fig. 1-4). Yes, it was *Hippeastrum angustifolium* and *Senecio icoglossus* just in flower. At the time I thought that I had found a new species of *Sprekelia* and collected a few plants with great joy for our Botanical Garden. Our driver in Paraguay, a 2<sup>nd</sup> generation Japanese immigrant, explained to us that this *Sprekelia* was a weed of rice fields in old days.

After returning to Japan, I studied many books to seek any information on this new *Sprekelia* but I couldn’t find anything about it. So, I asked to my friend at the Royal Botanical Gardens, Kew, about this plant. Yes, he knew it and sent me his photo which he had taken in Argentina. His opinion was *Sprekelia* sp., nothing more. At last, I found an article ‘*Hippeastrum* in the wild in Argentina’ in *Herbertia* Vol. 47 (Castillo, 1991),

and I knew at once the plant I had found was *Hippeastrum angustifolium*.

Near Tobati we also found a flowering clump of *Hippeastrum puniceum* in a dry locality (Fig. 5).

## CULTURE

The first year in our garden I placed the bulbs of *H. angustifolium* in the pool of 'Victoria Amazonica' in the greenhouse. Warm water temperature made them grow very well, but they did not flower. Then our guide in Paraguay informed me that he had been successful in flowering this bulb in his garden at Asuncion. He advised me that this *Hippeastrum* required winter cold to induce flowering. So, the second year, I prepared a small outside pool with a water depth of 5cm and flowing fresh well water of 25°C.

Our climate is 'Temperate Monsoon', with annual mean temperature of 15.7°C, maximum temperature 32~34°C, minimum 2~4°C, and annual rainfall 2360mm.

At last we were successful in flowering the bulbs in May 1995 some 3 years following their introduction (Fig. 6-8). We also could flower *Hippeastrum breviflorum* which was presented by my friend who had collected this plant in Brazil a few years before in similar wet conditions as *H. angustifolium* (Fig. 8-9).

The *H. angustifolium* bulbs were very healthy and multiplied very well, and they flowered every year continuously for almost 10 years time. As a result of crossing, we harvested quite a lot of seeds, and so I was able to donate seeds to the International Bulb Society twice during this era. Of course I sowed seeds and made many seedlings during those years. But, the parent bulbs were very vigorous and easily multiplied, so I didn't pay serious attention to the seedlings for many years because of the limited space in the small pool.

One year, it was very rainy during the spring and the bulbs of *H. angustifolium* were damaged severely by red leaf spot. Afterwards, they lost their vigor and the number of flower scapes declined year by year, and eventually flowering ceased. Then I understood the importance of regeneration from seed. But it was too late. Old seedlings were useless after long years of spoiling. That became the situation of our *H. angustifolium* collection.

Fortunately, I had presented the last fruit of *H. angustifolium* to my friend, a professional bulb breeder, and he was very successful in





**Fig. 1.** Road side view of the bog place near Tobati. The lavender flower is *Senecio icoglossus*.



**Fig. 2.** Road side view of bog place near Tobati. *Hippeastrum angustifolium* is flowering in the center.



**Fig. 3.** Wild plant of *Hippeastrum angustifolium* in flower.





**Fig. 4.** Close up of *Hippeastrum angustifolium* in the wild condition.



**Fig. 5.** *Hippeastrum puniceum* was just in flower near Tobati.



**Fig. 6.** At last we were successful to flower *Hippeastrum angustifolium* in May 1995 after 3 years of their introduction.



**Fig. 7.** *Hippeastrum angustifolium*.





**Fig. 8.** *Hippeastrum angustifolium* and *Hippeastrum breviflorum*.



**Fig. 9.** *Hippeastrum breviflorum*.



**Fig. 10.** *Hippeastrum angustifolium* (left), *Hippeastrum breviflorum* x *Hippeastrum angustifolium* (right).



**Fig. 11.** *Hippeastrum breviflorum* x *Hippeastrum angustifolium*.

growing and flowering them in his nursery. So, he can maintain them and propagate them. Knowing his successful result, I understand that my work was finished in popularizing this rare bulb in Japan.

### ***HIPPEASTRUM HARRISONII***

I obtained seed of *H. harrisonii* from a friend of Hawaii in 2000. He had traveled to Uruguay the same year as I went to Paraguay, and he collected this seed in a roadside river. Yes, this was a water loving *Hippeastrum* just like *H. angustifolium*, *H. breviflorum* and *H. santacatarina*. The collection locality was 30km from Rivera to Tacuarembó, Uruguay, near the frontier of Brazil. He said that it was a very common species around that area.

I was able to identify this species with my friend's assistance. I found it correlated with the illustration and description of *H. harrisonii* in Curtis's Botanical Magazine t.7737 (Hooker, 1900) (Fig. 18); Hooker's account specified *H. arechavaletae* as a synonym. Traub and Moldenke (1949) also treated *H. arechavaletae* as a synonym of *H. harrisonii* (see their discussion on p.114).

During the first 2 years I grew these seedlings on a bench in the greenhouse like other *Hippeastrum*. In the spring of their 3rd year, I planted 3 bulbs together in a large pot (30cm wide) and placed them in an outdoor pool like *H. angustifolium*. In May of their 4<sup>th</sup> year, they flowered abundantly (Fig. 12-15). They needed to experience freezing cold winter to produce flower spikes like *H. angustifolium*. From my experience they did not like hot humid greenhouse conditions of summer.

When I requested an identification of this species from Mauro Peixoto of Brazil and Julie Dutilh of Kew, they were not familiar with it. So, it must be a very rare species.

Five or six years after they began to flower, these bulbs began to lose their vigor and began reducing their flower spikes. So, I started to propagate from seed again, and possibly next spring we can expect the flowering of the second generation.

### **HYBRIDIZATION**

I crossed *H. breviflorum* with *H. angustifolium*. These hybrids flowered their 4<sup>th</sup> year.

Hybrid flowers never showed the character of the *Sprekelia*-like flower form of *H. angustifolium*, only the normal *Hippeastrum* flower form and

not showy (Fig. 12-15).

In the case of *H. harrisonii*, I crossed it with *H. parodii*. The hybrid flower was a little creamy but the same form as *H. harrisonii* (Fig. 16-17).

### COMPOST

I always use local materials, not special ones. My pot mixture consists of: 1 part of medium grain loam (1cm diameter), 1 part of small grain loam (0.5cm diameter) and 1 part of leaf mold. This loam's material is old volcanic ash with a little acidity and good drainage. So, this is the most popular compost material for pot plants in Japan. I mix in small amounts of MagAmp K (N:6; P:40; K:6; M:15) of medium grain when I make the compost. It is very simple, and this is the basic compost of my pot plant cultivation.

### All photographs by the author

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**Fig. 12.** In May of their 4th year, *Hippeastrum harrisonii* flowers abundantly. *Hippeastrum harrisonii* (left), *Hippeastrum angustifolium* (center), *Hippeastrum breviflorum* x *Hippeastrum angustifolium* (right).



**Fig. 13.** *Hippeastrum harrisonii* (left), *Hippeastrum breviflorum* x *Hippeastrum angustifolium* (center), *Hippeastrum angustifolium* (right).



**Fig. 14.** *Hippeastrum harrisonii*.



**Fig. 15.** *Hippeastrum harrisonii*.



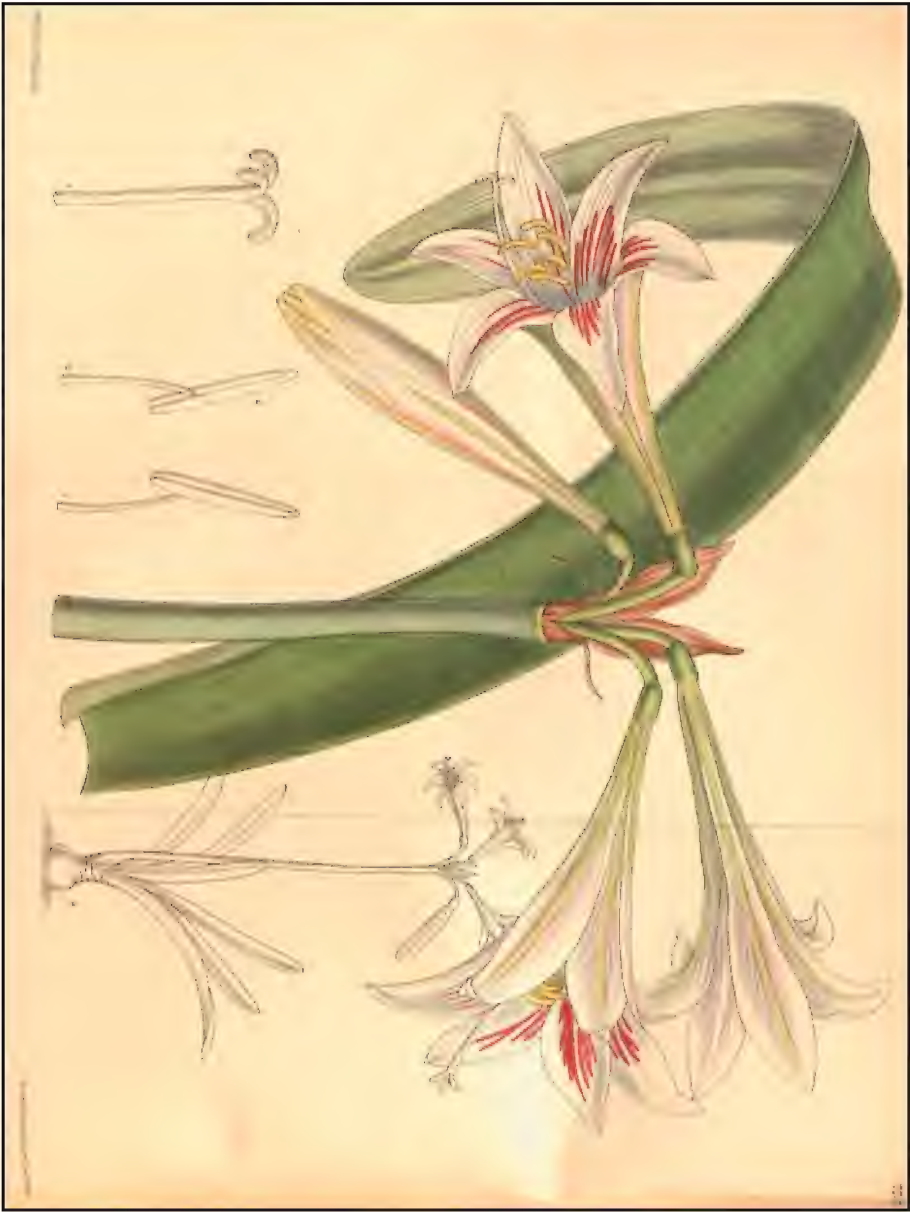


**Fig. 16.** *Hippeastrum parodii* x *Hippeastrum harrisonii*.



**Fig. 17.** *Hippeastrum parodii* x *Hippeastrum harrisonii*.

**Fig. 18.** *Hippeastrum harrissonii*, Curtis's Botanical Magazine c.7737, 1900.





## ON THE CLEISTOGAMOUS BREEDING BEHAVIOUR OF *TULBAGHIA GALPINII* SCHLTR. (ALLIACEAE)

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*Tulbaghia galpinii* is a very diminutive species endemic to a rather limited area of the Eastern Cape of South Africa. It was first described and named by the eminent German botanist Rudolf Schlechter in 1894 in honour of Ernest Galpin, one of the earliest plant collectors of the flora of the Cape. The morphology of the species is unique with a slightly fleshy six-lobed corona (Fig. 3) and thin glaucous leaves, and it has no close relatives within its own genus (see Appendix). Plants are usually found growing in a very dry habitat of rocky clearings, often within clumps of dwarf spiny euphorbias presumably as a protection against grazing herbivores (Fig. 1, 2).

Field experience by the author in his visits to all of the known growing sites as well as observations in cultivation has established that the species is apparently self-fertile (Vosa, 1975, 2000, 2007). However, controlled breeding experiments on a large number of plants carried out over a number of flowering seasons, together with visual observations, have shown the existence of a certain dimorphism in the morphological development of the flowers. The species begins flowering from the middle of September in the wild and about the end of March in Europe under glass cover. The flowering stem carries most often two flowers (Fig. 2, 3). Rarely, in robust plants and in cultivation, it may carry three or more flowers. The flowers have a relatively short perianth tube and are greenish-white in colour, often with a pinkish tinge to the edge of the perianth segments, usually fading dark pink. The apparent six lobed corona is made up of three deeply cleft lobes and is greenish yellow in colour (Fig. 3).

Typically the lower part of the perianth tube is only slightly swollen at the level of the ovary, but especially late in the flowering season, in some of the still unopened flowers the swelling is rather more conspicuous (Fig. 4).

In the course of this study a large number of such unopened flowers has been carefully dissected and observed under a stereo microscope at a fairly high magnification (x40), and in all cases the anthers were already in a state of advanced dehiscence and the stigmata were covered with pollen. As in normal fertilization in these flowers, the ovary swells until it is fully ripe when it becomes scarious and light brown in colour, eventually splitting loculicidally and releasing the black seeds (Fig. 5).

The swelling of the ovary, of course, derives from the ripening of the fertilized ovules and, in unopened flowers, this is a sign of cleistogamy. In *T. galpinii* our studies show that the mechanism involved includes the premature dehiscence of the anthers in some of the flowers, in fact a kind of facultative cleistogamy.

As in other phenomena of self fertilization, cleistogamy in a way may be considered useful to the species in order to ensure a measure of fertility, but leading to inbreeding, a negative factor which precludes genomic evolution and which may lead to extinction. Cleistogamy is present also in the related genus *Prototulbaghia* (Vosa, 2010) in which the single species *P. siebertii* is self incompatible, but the premature dehiscence of the anthers apparently takes place before the onset of the pollen/stigma incompatibility.

The peculiar morphological breeding as well as habitat wise status of *Tulbaghia galpinii* was recognized and previously discussed by Vosa (1975, 2000, 2007), and it is interesting that yet another special feature, namely a kind of facultative cleistogamy, has been found in this species.

## APPENDIX

*Tulbaghia galpinii* Schl. is a diploid species with a chromosome number typical of the genus ( $2n=12$ ,  $2x=12$ ) and the peculiar morphology of the corona places it as a single species in Sectio II of the subgenus *Eutulbaghia* (see Vosa, 2009). The species has a karyotype of Group D (Vosa, 1975, 2000) which includes *T. coddii*, *T. verdoorniae*, *T. natalensis* and *T. leucantha*. *Tulbaghia galpinii*, as all the species of karyotype Group D, possesses proximally located heterochromatic segments. Such segments in *Tulbaghia* are cold-sensitive (Dyer, 1963; Vosa, 1966, 1975, 2000) and consist of highly repetitive DNA sequences of Guanine-Cytidine nucleotides (Vosa, 2000). Analysis of meiosis has shown that in *T. galpinii*, as in *Tulbaghia* generally, crossing-over is almost exclusively proximal (Vosa,

1966b, 1973). It is evident that in this genus, genetic recombination is restricted to chromosome segments located more or less either side of the centromere. Thus, the distal chromosome segments only rarely undergo genetic recombination and are transmitted, apart from spontaneous gene mutations, unchanged to the next generation with obvious effects on the evolution of the genus (Vosa, 1966a & b, 1973, 2000).

#### ACKNOWLEDGEMENTS

I wish to thank all the people of South Africa for their kind help during my field excursions. I am also very grateful to the curators of the various herbaria world-wide for their kindness and hospitality, and to Liz Powney of Plant Heritage Nursery, Aberyswith, Wales, U.K. for her kind permission to use her photograph of the inflorescence of *T. galpinii* (Fig. 2).

**All photographs by the author except where indicated**

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**Fig. 1.** The rocky habitat of *T. galpinii*, 5km east of Bergquagga Park Gate, January 8, 2010.



**Fig. 2.** *Tulbaghia galpinii* in situ, left side of road, 48km north of Cradock, September 18, 1982.





**Fig. 3.** Typical two-flowered inflorescence of *T. galpinii*. (Photograph by Liz Powney)



**Fig. 4.** Inflorescence of *T. galpinii*. Note the rather swollen perianth tube at the level of the ovary of both closed fading flowers.



**Fig. 5.** *Tulbaghia galpinii* ripening cleistogamous seed capsules. Note the capsule on the left is already scarious, beginning to slit and showing the black seeds.

## NOTES ON THE DISTRIBUTION OF *BIARUM TENUIFOLIUM* (L.) SCHOTT (ARACEAE) IN TUSCANY, ITALY

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### INTRODUCTION

The genus *Biarum* (L.) Schott includes about 21 species and 6 subspecies of dwarf tuberous geophytes (Boyce, 2006, 2008) endemic to the semi-arid areas of the Near and Middle East, southern Europe and North Africa. Some morphological details of *Biarum* are different from all other genera of the Araceae present in its area of distribution, and according to Boyce (2006, 2008) the genus may be related taxonomically to other genera occurring further East.

Most species have been found to be quite variable in overall morphology (Engler, 1920; Boyce, 2006, 2008). Two species are known to occur in Italy: *Biarum tenuifolium* (L.) Schott, found in Central and South Italy, and *Biarum bovei* Blume found in Sardinia (Fiori, 1894, 1923; but see also Pignatti, 1997).

The cytotaxonomy of *Biarum*, especially at the infraspecific level, is not very clear and, at least for *B. tenuifolium* in Italy, various chromosome numbers ( $2n=16$ , 20 and 26) have been reported (Boyce & Athanasiou, 1991; Bedalov, 1969; Del Caldo, 1971; Marchant, 1972; Monti & Garbari, 1974; and see Table 1). The variation in chromosome number may be considered as evidence that *B. tenuifolium*, as a cytotaxonomic unit, could be undergoing a kind of adaptive speciation throughout its quite large and well differentiated distribution range. This hypothesis is supported by the

various subspecies and varieties so far described inhabiting diverse types of habitat.

In this context we would like to point out our discovery of large and well established populations of *B. tenuifolium* in eight amply spaced sites in Tuscany over an area of about 2,000 square kilometres. This is of great interest because the species itself has never been reported as occurring in the region (see Map 1). This may indicate either that the species has been seriously overlooked in the past for some reasons (see below) or that it is in a stage of a steady expansion northwards of its area of distribution in Italy.

The following account concerns the distribution of *Biarum tenuifolium* in Tuscany with notes on cytotaxonomy and ecology.

### MATERIALS AND METHODS

The material consisted of plants observed and collected in the wild in eight localities in Tuscany and two in northern Latium (see Table 1 and Map 1). Representative samples of living plants were cultivated in the open air in clay pots in a compost of sand, peat and ordinary garden soil. For the cytological preparations, actively growing root tips were pretreated in a saturated solution of 8-hydroxyquinoline for four hours and fixed in 1:3 glacial acetic acid/absolute alcohol overnight. After six minutes hydrolysis in 1N HCl at 60°C, the root-tips were squashed in 1.5% acetic-orcein, and the preparations were made permanent.

### RESULTS AND DISCUSSION

All the plants collected from the ten different sites (see Maps 1 and Table 1) are diploids with  $2n=2x=16$ . This is the same chromosome number as that found by Monti and Garbari (1974) for plants collected near Guidonia, Rome and by Del Caldo (1971) for plants of the var. *cupanianum* collected near Nicotra, Enna, Sicily. The chromosome complement of *B. tenuifolium* shows the typical linear differentiation patterns of allocyclic heterochromatic segments found in most genera of the family Araceae (Monti and Garbari, 1974).

*Biarum tenuifolium* (L.) Schott is a very variable hysteroanthous species found all around the Mediterranean Sea and in the Middle East and, besides chromosome number variation, it has also certain morphological variants usually classified as subspecies or varieties. More data gathered from more than forty specimens in various herbaria has shown that



*B. tenuifolium* flowering time varies very much in different locations. Flowering times range from February (three specimens) to December (1 specimen) and to June (ten specimens) for Middle East plants, whereas, in our study area, the species can be found in flower usually during the first two weeks of September.

Overall, the species is a small geocarpous plant growing preferentially in a calcareous rocky substratum (see Montelucci, 1949). In our area of study, it produces a rosette of bright green leaves with somewhat wavy margins which emerge around the middle of October after the first autumn rains and seem to reach their full development about two to three weeks later (Fig. 1). The leaves are visible all through the winter to early summer period, withering and drying up well before anthesis which occurs usually at the beginning of September (Fig. 2). Our field experience in Tuscany and northern Latium (see Map 1), which extended over eight growing seasons, has shown that in *B. tenuifolium* the narrow oblong-lanceolate leaves resemble at first glance those of *Plantago lanceolata* L. which shares the same habitat. In most cases only careful and close observation can distinguish the leaves of *Plantago* from those of *Biarum*.

Furthermore, the rather small number of flowering plants even in large populations together with the ephemeral flower, about a week or so, may have led to an underestimation of the occurrence of our species. Moreover, the single flower is not very conspicuous and consists of a wide purple/back spathe often with a striking green tip which in some plants may occupy at early anthesis almost half of its length (Fig. 3). The spadix is rather long, dark reddish-brown in colour and worm-like in shape (Fig. 2, 3). At full anthesis the spadix emits an intense foetid smell reminiscent of rotting sheep or goat dung with a strong hint of rotten flesh, which attracts insects such as carrion flies mostly of the family Calliphoridae or Blue-Bottle Flies which seem to be the main pollinators.

Because of its colour, the flower of *B. tenuifolium* is not readily visible in the vegetation covered rocky ground often strewn with dead leaves (Fig. 4), and the strong smell is often the only sign of the presence of the plant in bloom. The smell is all pervading and so powerful that it is perceived especially downwind even when transiting by car along roads or country lanes with the plant in flower nearby.

Some recent chance observations have revealed an interesting fact which most likely may somewhat reduce the occurrence of *B. tenuifolium*

at least near human settlements. Because of its distinct organic smell, the flower attracts and is often spoiled or even eaten by domestic cats.

## CONCLUSIONS

All evidence gathered in the present study points to the fact that *B. tenuifolium* is found in large parts of southern Tuscany, a region where the species has never been observed before.

*Biarum tenuifolium* is a rather elusive entity, somewhat difficult to detect readily in nature. Therefore, we could argue with reason that the apparent northwards expansion of its distribution area may be due either to under collecting and/or to lack of close observations or to a natural occurrence. In any case, on the basis of our experience and of our extensive field work, we consider the second hypothesis at the moment as not very probable.

## All photographs by G. Pistolesi

## APPENDIX

*Geocarp*y is the ripening of the seeds below ground level, thus in a way limiting their eventual long distance dispersal. This limitation may be important in species such as *B. tenuifolium* which grows in a kind of special habitat where excessive seed dispersal may be a negative factor. The avoidance or the limitation of seed dispersal in plants is termed *atelechory* and often occurs in plants growing in desert or rocky terrains. *Hysteranthous* is the term which indicates plants, especially geophytes, in which the leaves develop after flowering.

## ACKNOWLEDGEMENTS

We wish to thank the curators of various herbaria but especially those of the following universities: 'La Sapienza' of Rome (RO), Florence (FI) and Siena (SIENA) for their valid help and collaboration.

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**TABLE 1. CHROMOSOME NUMBER IN *BIARUM TENUIFOLIUM*.**

- 2n= 26: Yugoslavia. Bedalov, 1969.
- 2n= 26: var. *abbreviatum*, Yugoslavia, Macedonia. Marchant, 1872.
- 2n= 20: Monte Pellegrino, Palermo, Sicily. Monti and Garbari, 1974.
- 2n= 26: Madonie Mountains, Palermo, Sicily. Monti and Garbari, 1974.
- 2n= 16: Guidonia, Rome. Monti and Garbari, 1974.
- 2n= 16: var. *cupanianum*, Nicotra, Enna, Sicily. Del Caldo, 1971.
- 2n= 16: Marrucheti. Vosa and Pistolesi (present paper).
- 2n= 16: Alberese. Vosa and Pistolesi (present paper).
- 2n= 16: Magliano. Vosa and Pistolesi (present paper).

**TABLE 2. LOCALITIES OF COLLECTION OF *BIARUM TENUIFOLIUM* IN SOUTHERN TUSCANY (a) AND NORTHERN LATIUM (b).**

**(a) Province of Grosseto:**

Alberese, Lagaccioli, La Marsiliana, Madre Chiesa, Marrucheti, Magliano, Preselle, Sgrillozzo.

**(b) Province of Viterbo:**

Ponte San Pietro (Farnese), Canino.

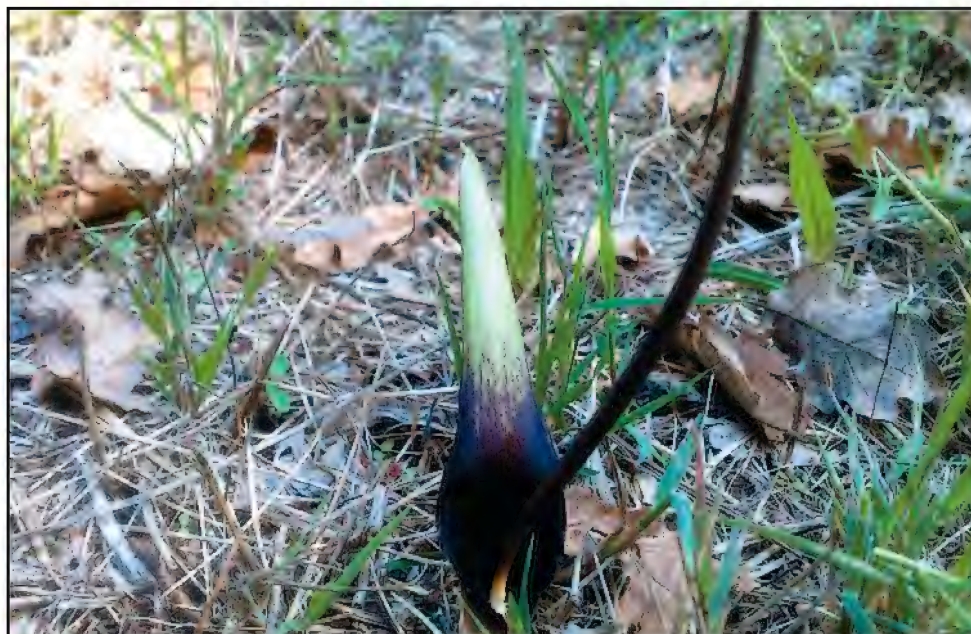


**Fig. 1.** The characteristic leaf rosette of *Biarum tenuifolium* about the middle of October. Note the calcareous rocky habitat.



**Fig. 2.** *Biarum tenuifolium* in flower at the beginning of September at the Madre Chiesa site.





**Fig. 3.** Note the rather large green apical portion of the flower spathe in this particular plant of the Madre Chiesa population of *Biarum tenuifolium*.



**Fig. 4.** The typical habitat of *Biarum tenuifolium* in an abandoned olive-grove near Alberese, southern Tuscany.



**Map 1.** The collecting sites of *Biarum tenuifolium* in southern Tuscany (red dots) and in northern Latium (green dots). The names of the principal towns as well as the regional capital, Florence, are indicated.

# EFFECTS OF GAMMA IRRADIATION ON *NARCISSUS* WITH PARTICULAR REFERENCE TO INDUCTION OF SOMATIC MUTATION

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## INTRODUCTION

*Narcissus* (*N. papyraceus*) is an ornamental, fragrant bulbous plant belonging to family Amaryllidaceae (Banerji et al., 2010). The plant is native to Europe, North Africa and Asia. This perennial plant was named after the legendary Greek youth Narcissus who was strikingly handsome. The word 'narcissus' is derived from the Greek word *narke*, meaning numbness or stupor. Some attribute the naming of the flower to its narcotic fragrance while others debate that it is associated with the poisonous nature of *Narcissus* bulbs. It is one of the important flowers in the world and is the most popular flower in Germany. The most common *Narcissus* species found growing throughout America today were brought over from Europe by the early colonists and distributed westward by settlers from the East. *Narcissus* is mainly cultivated in the Channel Isles, the Isles of Sicily, Great Britain, Holland and India. Daffodil is the common English name sometimes used for all varieties and is the chief common name of horticultural prevalence used by the American Daffodil societies.

Narcissi (plural form of *Narcissus*) are easily grown from bulbs. *Narcissus* flowers are usually white or yellow and are characterized by a narrow, tubular base (hypanthium), three petals and three petals like sepals (the perianth), and a central cup like appendage (the corona, cup or crown) that may be of contrasting colour. The three outer segments are sepals, and the three inner segments are petals.

In the present investigation, bulbs of *Narcissus* were irradiated with different exposure of gamma rays to study its effects with particular reference to induction of somatic mutation in foliage/flower colour and form.

## MATERIAL AND METHODS

Dormant bulbs of *Narcissus papyraceus* (diameter 3.0cm, weight 17.0g and height more than 5.0cm, colour Grayed-Orange Group164A, Fan-4) (Fig. 3a) were irradiated with 0, 250, 500, 750 and 1000 rads of gamma rays in a gamma chamber-900 model, a  $^{60}\text{Co}$  source at the Floriculture Section, CSIR-National Botanical Research Institute, Lucknow, and planted immediately afterwards in pots. Each treatment group consisted of 35 bulbs. Data were recorded on sprouting, days to sprout, number of sprouts, plant height, survival, leaf number, leaf size (length and width), morphological abnormalities in foliage, plants with abnormal leaves, length of spikes, flowering behaviour (days to bud initiation, days to first colour shown and days to full bloom), size of flowers across, weight of flowers, pedicle length, number of petals per flower, petal size (length and width), number of stamens per flower, and colour of flowers (pedicle, ovary, anther lobe and stigma). Colour of flowers and floral organs was recorded with the help of Royal Horticulture Society Colour Chart (Anonymous, 2001). Plants with sectorial chimeras (chlorophyll variegation) were labeled to isolate the variegated plants in pure form.

## RESULTS AND DISCUSSION

Sprouting was severely affected by gamma irradiation. In control plants, 100% sprouting was observed, while after 250 rads of gamma irradiation there was a drastic decline of sprouting and after 500 rads of exposure only 40% sprouting was observed. In the highest treatment exposure of 1000 rads, only 10% sprouting was recorded (Table 1). Sprouting started after 15 days of planting in the control population, while it was delayed in different treatments of gamma rays. Reduction in sprouting, survival, plant height and delayed flowering was earlier reported in *Gladiolus psittacinus* var. *hookeri* after gamma irradiation (Gupta and Banerji, 1977; Banerji et al., 2001). Plants attained a height of 32cm in the control population, while height was reduced after different exposures of gamma irradiation. In general, height of mature plants was reduced with increasing exposure to gamma rays (Fig. 1a). The maximum reduction of 29cm was observed at the highest dose of 1000 rads. In all the cases this reduction of plant height was significant at  $P < 0.001$  level. The control group leaves were normal and green in colour (Fig. 2a), while after gamma irradiation plants with abnormal leaves and total abnormal leaves increased with increasing



exposure to gamma rays (Table 1). Leaf length and width were significantly reduced ( $P < 0.001$ ) after highest exposure of gamma irradiation (Table 1). At 750 and 1000 rads the leaf size was drastically reduced, and leaf morphology was entirely changed and looked like a leaf blade of grass (Fig 1a). Gupta and Banerji (1977) and Banerji et al. (1994) reported similar results after irradiating *Gladiolus* corms with gamma rays.

Survival of the plants was markedly reduced after irradiation. In the control population no casualty was recorded, while after 250 rads survival was reduced to 95%, followed by 80%, 40% and 10% after 500 rads, 750 rads and 1000 rads respectively (Table 1).  $LD_{50}$  on a survival basis was determined to be in between 500 and 750 rads of gamma rays. Banerji (1982) determined the  $LD_{50}$  dose in *Gladiolus* after gamma irradiation and calculated it more accurately by using a calculation proposed by Reed and Muench. Very good root formation was observed in bulbs of control plants (Fig. 3b), while it was severely affected after gamma irradiation, and in extreme cases root formation totally ceased (Fig. 3c & d). An effect of different doses of gamma irradiation on adventitious bud formation from bulb scale of Chinese *Narcissus* (*Narcissus tazetta* var. *chinensis*) has been reported by Gang et al. (2007). They found that the regeneration of Chinese *Narcissus* was very sensitive to gamma radiation even at low doses. The survival and multiplication rates significantly decreased with an increase in radiation dose. The high frequency of mutants detected by molecular markers indicated that treatment of in vitro culture with gamma rays may be an effective way to improve *Narcissus* cultivars.

Morphological abnormalities in foliage included fusion of leaf blades, reduction in length and width of leaves, and chlorophyll variegation in light green, creamish white, golden and white colour stripes (Fig. 1c-f & Fig. 2b-i). Chlorophyll variegated mutation appeared in *Narcissus* leaves in sectorial chimeric form after gamma irradiation in  $VM_1$ . The range of variegation in leaves began with one leaf in a plant to a few leaves, and in extreme cases an entire plant with variegated leaves was observed. All these plants were labeled to isolate the chimera in pure form in  $VM_2$  and in subsequent generations. Banerji et al. (1981) reported similar results after gamma irradiation of *Gladiolus* corms where they observed light and dark green foliage, sickle shaped and grass like leaves, etc. Per cent abnormal plants and plants with abnormal leaves induced by gamma irradiation were increased with increasing exposure of gamma rays (Table

1). Similar observations were recorded in Tuberose (Datta and Shukla, 1996; Shukla and Datta, 1994). Flowering was normal in control plants (Fig. 1b). Flowering (days to bud initiation, days to first colour shown and full bloom) was delayed after gamma irradiation. Flower size, height, weight and tube length were affected after gamma irradiation. Significant ( $P < 0.001$  and  $P < 0.01$ ) decreases in flower size and weight were observed at the highest exposures of gamma irradiation. However, floral organ (petals, stamens and stigma) numbers remained the same as in the control group after gamma irradiation (Table 1). Petal size (length and width) reduced significantly ( $P < 0.001$ ) after gamma irradiation. Reduction in flower size of Narcissus after gamma irradiation was due to reduced petal size. Banerji et al. (1981) reported reduction in flower size of *Gladiolus psittacinus* var. *hookeri* cv. orange after gamma irradiation. Flower colour remained unaltered after different exposures of gamma irradiation (Table 1). Flowering was drastically affected after irradiation, and at the higher exposure of 1000 rads, flowering was completely inhibited due to inhibition in spike formation. Gupta and Banerji (1977) and Banerji et al. (1994) observed complete inhibition of spike emergence in Gladiolus cultivars after high exposures of gamma irradiation. It may have been due to the stunted growth of the plants which hardly produced 2-3 very small leaves similar to a green blade of small grass. Banerji et al. (2001) reported similar results after gamma irradiation of Gladiolus corms, and this aspect has already been reviewed by Misra and Banerji (1978) and Banerji and Datta (1987a, b). Gamma rays have been successfully used at the floriculture section for development of chlorophyll variegated mutants in Bougainvillea (Banerji, 2012a, b & c). Gupta et al. (1974) obtained two gamma-ray-induced chlorophyll-variegated mutants in Tuberose and released them under the names 'Swarn Rekha' and 'Rajat Rekha'.

In the present investigation, effects of gamma irradiation on vegetative and floral characters have been studied in detail. Bulbs of chimeric plants showing induced variegated leaf patterns are being maintained separately to isolate the variegated tissues in pure form in order to release them as new cultivars.

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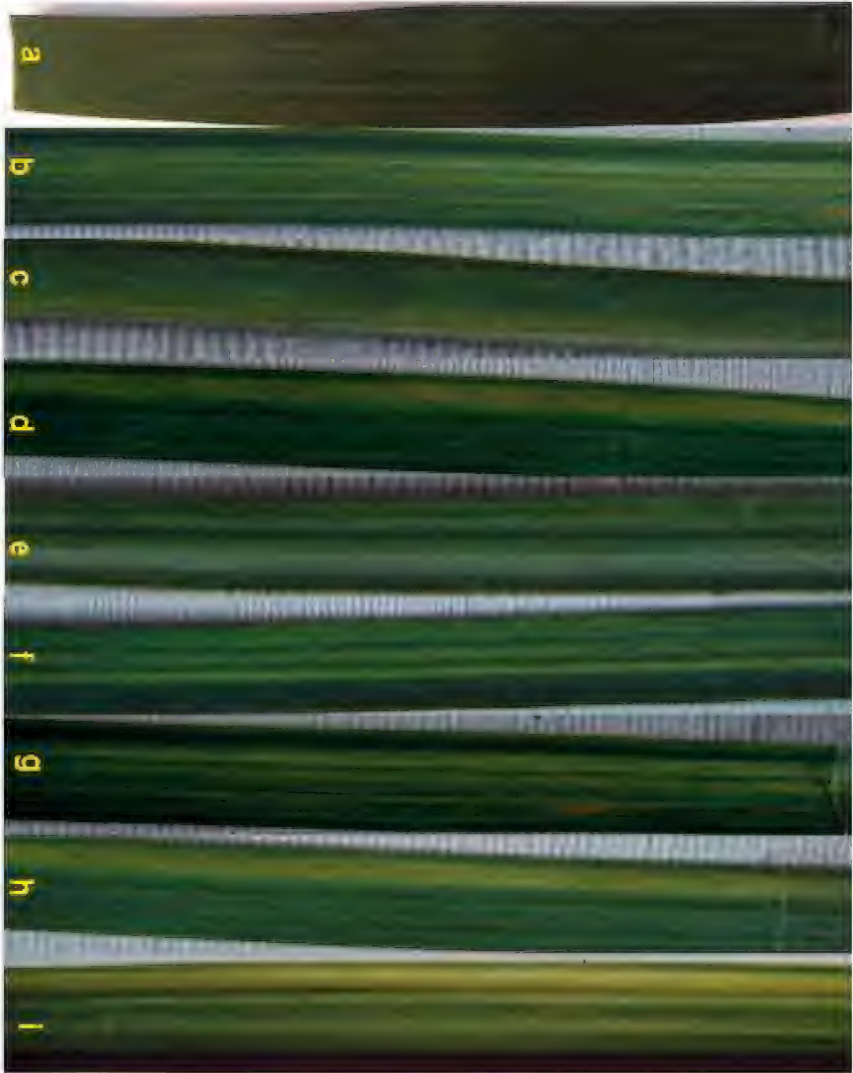
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**Fig.1 a** Control('1') and gamma ray irradiated plants (2-5) of *Narcissus* **b** Mature plant in full bloom stage  
**C- f** Different types of chlorophyll variegation on narcissus leaf induced after gamma irradiation



**Fig 2.**Gamma ray induced different types of chlorophyll variegation in Narcissus leaf. a- control leaf  
b-d. light green stripes e. silver stripes f-g. broad light green stripes h-i. broad yellow stripes



**Fig. 3. a** Bulbs of *Narcissus* (Control) **b**. Control bulb with profuse rooting **c** & **d**. Gamma ray irradiated bulb with single and inhibited root in higher doses



TABLE 1. VEGETATIVE AND FLORAL CHARACTERS OF CONTROL AND GAMMA IRRADIATED NARCISSUS PAPYRACEUS BULBS.

Characters	Control	Treatment (Gamma rays) Rad			
		250	500	750	1000
Days to sprout ± SE	0 15.57±0.61	100 42.3±3.90	80 57.9±4.77	40 83.9±5.43	10 92.5±4.69
Sprouting (%)	100	100	80	40	10
Plant height (cm) ± SE	31.6±1.97	17.3±1.04***	10.3±0.15***	7.13±0.14***	2.49±0.13***
Survival (%)	100	95	80	40	10
Number of leaves ± SE	19±1	13±1**	6±0***	3±0***	2±0***
Length of leaves (cm) ± SE	30.7±1.29	22.4±1.05***	16.1±0.18***	6.18±0.16***	0.46±0.01***
Width of leaves (cm) ± SE	1.47±0.05	1.01±0.03**	0.51±0.03**	0.32±0.01***	0.26±0.01***
Leaf abnormality (%)	0	13	17	80	100
Plants with leaf abnormality (%)	0	20	35	100	100
Days to bud initiation ± SE	39.4±0.78	51.01±2.41***	57.9±2.01***	60.01±3.99***	-
Days to first color shown ± SE	50.43±1.67	64.9±2.71***	67.5±2.89***	74.2±3.99***	-
Days to full bloom ± SE	54.20±2.47	70.9±3.77***	73.2±3.87***	80.0±3.42***	-
Weight of fresh flowers (gm) ± SE	0.45±0.03	0.40±0.02**	0.36±0.01**	0.31±0.01***	-
Size of flower across (cm) ± SE	3.17±0.12	2.91±0.01*	2.76±0.01*	2.32±0.01**	-
Tube length (cm) ± SE	1.69±0.02	1.53±0.01**	1.51±0.01**	1.02±0.01***	-
Height of flowers (cm) ± SE	1.05±0.01	0.98±0.01*	0.81±0.01**	0.80±0.01**	-
Pedicel length (cm) ± SE	2.77±0.07	2.62±0.10**	2.00±0.01*	1.82±0.01**	-
Number of petals ± SE	6±0	6±0	6±0	6±0	-
Length of petals (cm) ± SE	1.92±0.04	1.67±0.01*	1.65±0.01**	1.52±0.01***	-
Width of petals (cm) ± SE	1.30±0.08	1.16±0.01*	1.14±0.01**	1.02±0.01***	-
Number of stamens ± SE	3±0	3±0	3±0	3±0	-
Color of flower	White Group 155D fan 4	White Group 155D fan 4	White Group 155D fan 4	White Group 155D fan 4	-
Color of pedicel	Yellow Green Group 144B fan 3	Yellow Green Group 144B fan 3	Yellow Green Group 144B fan 3	Yellow Green Group 144B fan 3	-
Color of ovary	Green Group 137A fan3	Green Group 137A fan3	Green Group 137A fan3	Green Group 137A fan3	-
Color of stamen	Yellow Group 13A fan1	Yellow Group 13A fan1	Yellow Group 13A fan1	Yellow Group 13A fan1	-
Color of stigma	Green White Group 157A fan 4	Green White Group 157A fan 4	Green White Group 157A fan 4	Green White Group 157A fan 4	-

\* = P< 0.02, \*\* = P< 0.01, \*\*\* = P< 0.001



## LYCORIS HEAT REQUIREMENT AND OTHER OBSERVATIONS

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In recent years we have been able to import thousands of Lycoris bulbs. One of the main advantages to importing them ourselves is that we receive the bulbs as soon as the crop is available. If we relied on wholesalers, we would have to wait for the standard fall planting season. The bulbs arrive without any roots, looking just like commercially produced daffodils.

With early planting, amazing root systems develop in just a few weeks. In fact, these very dry and dormant bulbs bloom with surprising reliability, provided they are of blooming size to begin with. We are now convinced that the critical factor for Lycoris bloom and root growth is warm soil (Hong-wei, 2010) provided by early planting. This contradicts our former belief that dry bulbs without roots will rarely bloom.

The Lycoris bulbs arrived here in Arizona between the end of July and the middle of August. In 2011 we planted them by hand between mid August and the end of November. This gave us an opportunity to see the effect that planting time had on growth, bloom, and establishment.

Those bulbs which were planted between August and September grew roots quickly, and they generally bloomed within 3 to 8 weeks of planting. Bulbs which were planted in October generally did not bloom well, but still grew a good root system and foliage; they lagged noticeably behind earlier planted bulbs but were mostly caught up by spring. For bulbs planted in November, root growth was very poor. It would seem that soil temperatures above 70°F were required (See Table 1.) Sometimes bulbs would grow one or two small roots but never a full root system. Even limited roots were able to support some foliage growth. Bulbs with no root growth still attempted to produce foliage during the cool season, but these leaves soon withered away for obvious reasons. After temperatures heated up in late spring, these bulbs rooted heavily, and foliage was produced at

the usual time. Essentially, planting bulbs late meant that they would lose a growing season.

Unrooted *Lycoris* may also be more sensitive to cold damage. In *Narcissus*, rooted bulbs can survive colder temperatures than unrooted bulbs (Welch, 2010). Similar chemical changes may occur in *Lycoris* in preparation for winter. After we had our all-time winter cold of nearly 0°F, we found a rooted *Lycoris aurea* bulb which had been dropped on top of the soil, fully exposed. The foliage was destroyed, but the bulb itself was still solid and viable. Such a display of cold resistance from this most tender of *Lycoris* species was surprising to say the least. It indicated an extreme evolutionary journey. No wonder these flowers are so popular with those of us from extreme climates.

Summer heat for proper root growth is apparently necessary for both spring and fall foliage types. We have imported a wide variety of *Lycoris*, including: *Lycoris radiata*, *L. albiflora*, *L. incarnata*, *L. sanguinea*, *L. squamigera*, *L. 'Blushing Lady'*, *L. 'Flaming Dragon'*, *L. traubii*, and *L. aurea*. Only 'Flaming Dragon' has not bloomed well for us on the first year of planting. The latter bulbs were quite small, less than 2cm in diameter. Likely they were not yet blooming size.

In 2012 we made a great effort and planted all our *Lycoris* before mid September. Root growth was rapid, and an extensive root system was produced in as little as 3 weeks.

There is evidence that nutrient availability increases with soil temperature (Pregitzer & King, 2005). Warm temperatures and monsoon rains provide nutrients which are needed during the cold growing season. The bulb is a dual storage device. It provides both the carbohydrates and nutrition required for rapid growth at a time when competition from other plants is low.

Time of bloom for newly planted bulbs was later than for established plantings. For example, *Lycoris sprengeri* bloomed in September, while its normal bloom time was in July. This raises several important questions: Is it possible to time *Lycoris* blooms for a specific date? How long can bulbs be stored before flowers are aborted? What temperature treatments and conditions would be required? These are very important questions for those considering *Lycoris* as a commercial crop.

The brief mention of a few experiments may help direct future research. Bulbs which were planted in December and kept in our 75°F

basement rooted well, while bulbs planted outside at the same time did not root at all. Perhaps late bulbs could be rooted inside, and then transplanted outside for further growth. This would be an artificial “warm treatment” rather than the “cold treatment” traditionally given fall bulbs. This could prevent the loss of a growing season.

We have delayed the bloom of *Lycoris albiflora* by keeping bulbs in the refrigerator for one month past the normal time of bloom. They were dug just before the bloom buds started to emerge, and the roots were preserved inside a plastic bag with sand. After being planted in pots and kept at room temperature, the bulbs bloomed within one week. There were no apparent negative effects. Japanese research indicated that flowering was postponed for 19 days in *Lycoris radiata* with four weeks of storage at 6°C (Lei et al., 2009).

We have also bloomed *Lycoris aurea* bulbs 8 months after they had been imported. The bulbs were stored in a dry box and kept in our basement from January until being planted in August. They bloomed soon after, one month earlier than usual. *Lycoris radiata* given the same treatment did not bloom.

In our opinion, *Lycoris aurea* has the best traits for commercial development. It is tolerant of container culture, has large flowers, and is the longest lasting of its kind as a cut flower. Likely it will be the easiest species to program with temperature and other treatments. Recent research in China shows that 21 days with 27°C day/15°C night temperatures triggered 89% of *Lycoris aurea* bulbs to bloom (Ou, 2011).

We have extended the *Lycoris aurea* blooming season by withholding water starting in August, and then irrigating a new section every two weeks thereafter. By this method we have new flowers from September through early November. Our desert climate lends itself to such treatment, but similar results could be had anywhere with a greenhouse.

For this reason we are using *Lycoris aurea* frequently in our new hybrids. We now have thousands of blooming *Lycoris* for our hybridizing work, years earlier than expected. Seed set has been good on our newly planted *Lycoris*. New bulbs which bloomed in 2011 also bloomed in 2012, indicating that transplant shock is largely eliminated with early planting.

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**TABLE 1. LYCORIS PLANTING IN ARIZONA AT 3000FT, USDA ZONE 8. EFFECTS OF PLANTING UNROOTED BULBS EACH MONTH ON SUBSEQUENT ROOT GROWTH AND BLOOMING.**

Month	Avg High Temp	Avg Low Temp	Soil Avg Temp	Root Growth	Bloom
Jul	100°F	70°F	85°F	Good	On Schedule
Aug	100°F	70°F	85°F	Good	2-4 Week Delay
Sep	94°F	61°F	81°F	Good	4-6 Week Delay
Oct	86°F	47°F	72°F	Good-Fair	Sporadic
Nov	70°F	36°F	59°F	Poor	None
Dec	56°F	31°F	47°F	Poor	None



# METHODS AND MOTIVES FOR INDUCING POLYPLOIDY

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Traditionally plant chromosomes have been doubled with colchicine, but there are safer chemicals now available. We have found Oryzalin, also called Surflan (a pre-emergent herbicide), to be the easiest way to induce polyploidy (van Tuel, 1992). In the USA it is available as a 40% concentrate. Our method (adapted from others) is to use a few drops (0.1ml) in four liters of water. Chop the bulbs into chips, and soak the bulbs overnight in the solution. Rinse thoroughly with clean water, and incubate in a fungicide treated media.

With this method we have had bulblets form which show thicker leaves than the original variety, which is promising sign of polyploidy. Without a proper microscope we cannot test them further. One study with *Lilium* indicated that 68% or more of treated bulblets were polyploid (Takamura, 2007). We are relying on repetition to ensure that we create a large number of polyploids.

Our main motivation for inducing polyploidy is to restore fertility to sterile hybrids. Basically by doubling an odd set of DNA (often triploid) you create enough chromosomes for balanced gametes to form. A triploid will turn into a hexaploid, so any resulting offspring will have a full set of the original triploid chromosomes from the sterile triploid, plus whatever chromosomes are added by the other parent. Thus a hexaploid and a diploid will produce a tetraploid, which is likely to be fertile and have polyploid vigor.

For *Lycoris* I have treated bulbs of just about everything in my collection, including triploid *L. radiata*, *L. albiflora*, *L. aurea*, *L. incarnata*, *L. sanguinea*, *L. sprengeri* and *L. squamigera*. By restoring fertility to the sterile hybrids and doubling the chromosomes for the species, we are hoping for new DNA combinations in the next generation of hybrids. What would a triploid with one part each of *L. radiata*, *L. aurea* and *L. sprengeri* look like? We would like to know too.

Hybrid *Hippeastrum* are already mostly tetraploid, with a few triploids and diploids thrown in. Mostly we have treated diploid species to restore the fertility of offspring with the hybrids.

We have treated our *xAmarcrinum* hybrids in hopes of restoring fertility. If a tetraploid version was fertile, then hybridization could continue among the bi-generic hybrids, instead of being restricted to the original cross of *Amaryllis belladonna* x *Crinum*.

We are planning to treat just about every bulb in our collection (fertile and infertile) with which we would like to hybridize. These include *Amaryllis*, *Zephyranthes*, *Rhodophiala*, *Iris*, *Narcissus*, *Nerine*, *Clivia* and *Crinum*. We'll keep you posted on the results.

Another method for inducing polyploidy is to expose plant cells to nitrous oxide under pressure (Kihara, 1960). We thought this kind of thing was beyond us, but recently we found a simple solution. For less than \$80 we purchased a 1 liter commercial whip-cream dispenser and 80 small cylinders of N<sub>2</sub>O. The fantastic thing about nitrous oxide is that it can be used on pollen, ovum, zygotes, and seeds. It is not a herbicide, so it isn't likely to kill your little seedlings. By inducing polyploidy in pollen there is the potential to make fertile pollen from sterile triploid varieties. Last September we put flowers with unopened anthers of triploid *Lycoris radiata* var. *radiata* into the canister and added 2 cylinders of N<sub>2</sub>O to pressurize the system for 24 hours. When we opened it again, the pollen had fluffed open. Upon microscopic inspection the pollen included abnormally large grains. Similar large pollen grains have been observed when inducing polyploidy with *Lilium* pollen (Akutsu, 2007). We daubed this pollen around and obtained fat seeds on our *Lycoris sprengeri* and *L. aurea*. We have bees, so there are no guarantees, but we're excited by the possibilities.

We want to make a larger container which will hold fleshy stems capable of producing seeds when separated from their bulbs. If stems from sterile varieties produce seeds, we will know fertility has been successfully restored. Our hope is that this method will allow seed production from sterile cultivars today, without waiting the years required for an induced polyploid bulblet to mature and bloom.

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## ***EUCHARIS* x *GRANDIFLORA* AND ITS FLOWER REGULATION**

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*Eucharis x grandiflora* is a remarkable flower within the Amaryllidaceae family. Hardly any flowers are so pure white and express so much beauty as the delicate flower from this South American forest plant.

I remember my father telling how my grandfather Piet Berbée searched for ways to manipulate his greenhouses with *Eucharis* in flower, by changing temperatures and moisture levels in the soil, and later, during the 1960's, by regulating the soil temperatures with a soil-heating system in the substrate beds. These uplifted flowerbeds with sides made out of bricks were used for growing carnations on a replaceable medium as well. Initially he used metal pipe, the PE-tube had not been introduced yet. Aalsmeer's first waterflow pump for a soil heating system was installed in some of these greenhouses during a time when heating greenhouses was mainly done by natural water circulation from a charcoal burner. When my grandfather finally found a reasonable method for forcing the flowers, he was able to achieve beds in flower 2-3 times per year, although some seasons were more successful (higher flower percentages) than others. The method would be researched and optimized by J. Van Bragt and P.A. Sprenkels (1983) of Wageningen University. In 1966 my grandfather was able to supply *Eucharis* flowers for the Queen's Wedding Bouquet and the royal corsages through Pim Vreeken of Vreeken Export, which made the flower far more popular in the Netherlands than before, and really made flower arrangers aware of the possibilities to use it for wedding events.

I only started growing *Eucharis* as a commercial cut flower in 2000 at our Amaryllis nursery in Hem (North Holland, close to Enkhuizen) and only on a relatively small scale. In 2006 we moved our *Eucharis* production to Tenerife (Canary Islands) where we co-operated with Alberto Beautell. Alberto had been producing *Geranium* cuttings for the German market for years and was a fantastic grower and became a good friend. In these years I received some practical help from Herman Weitkamp who specialized in





**Fig. 1.** *Eucharis x grandiflora* as grown by Luxor/Berbée Amaryllis in Limuru, Kenya in 2012.

rare succulents and *Strelitzia reginaea* for cut flower exports.

During this period we found that *Eucharis* really benefited from a regular steady climate and sufficient shade during the bright periods. The climate of Tenerife, especially the north coast, was a very mild subtropical sea climate with night temperatures never going under 10°C and maximum day temperatures hardly ever exceeding 32°C. We found that if grown under high light intensities, the quality of the leaves was good enough to be used as decoration material.

Although we were growing 3000m<sup>2</sup> on a ‘picón’ substrate, we noticed that bulbs grew far more easily in the soil; whereas with *Hippeastrum*, we always found that we could obtain fantastic results in several (clay granulate, pumicestone) substrates. Sometimes we would experience some light sea salt damage on the leaves, but only in cases of heavy storms with high light intensities shortly afterward.

In 2011 we moved all our productions to East Africa, mainly because of rapidly rising energy costs in the Netherlands, changing flight schedules and labour costs on Tenerife. The only operation remaining in the Netherlands was issuing varieties from our *Hippeastrum* breeding program (which I started in 1989) for Dutch commercial growers, about which I will write about soon.

I chose to grow the *Eucharis* under thrip net and then covering it with a shade net of 60%. I found that 'start growth' under low air humidities was not always so easy with *Eucharis*. I have received the impression that *Eucharis* only comes 'in balance' when sufficient leaves have been made and the crop itself is able to 'regulate the climate' and protect itself against some low air humidities during the daytime. Of course we could consider re-planting *Eucharis* together with the leaves, which might bring the plant in balance more easily, but that could not be combined with a warm water treatment as we usually do with the bulbs every few years. To maintain the humidities during the daytime somehow, we installed polythene 'fences' in every bay and surrounding the walls of the shade house. We installed a soil heating system ourselves, using two loops of PE tube in every bed. This circulation system was then combined with a partial insulated 'bulb cooking' machine which was quite unique according to the supplier Akerboom in Noordwijkerhout, but it proved to be effective.

The natural soil temperature in the area where we were based was between 15 and 19°C, cool enough to use only a heating system for flower regulation. A program was set up to obtain two flower beds in full flower every week, producing a few thousand stems. A disadvantage of the present regulation system was the amount of fuel being consumed, and therefore we have been developing a solar heating system through which we would be able to regulate in a cheaper and better way – and at the same time become independent from the somewhat irregular electrical power supply in Kenya.

Of course I have studied possibilities to come to an alternative system of flower regulation, but in the studies published by some researchers following the first article of Van Bragt & Sprenkels, I have never really found any essential difference to the temperature schedules we're using presently.

The question is: Could the flowering time be regulated in any other way? Would an easier, less energy consuming or more effective way be possible? We have been experimenting with some growth regulators and some other methods and will keep on searching.

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## MUSINGS IN INTERGENERIC HYBRIDS – 2. BACK/OUTCROSSING OF *xSPREKELIANTHES* LEHMILLER AND A NEW TRIGENERIC HYBRID (AMARYLLIDACEAE)

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The author (Lehmillier, 2003-4) reported the bigeneric hybrid cross between two members of family Amaryllidaceae, *Sprekelia* and *Zephyranthes*, and defined the nothogeneric taxon *xSprekelianthes* (Fig. 1).

*xSprekelianthes* = *Zephyranthes traubii* ♀ x *Sprekelia formosissima* ♂

The original cross was accomplished in the spring of 2000 using two different bulbs of *Z. traubii* as seed parents and resulted in multiple hybrid bulbs; very little variation was evident among the progeny. As demonstrated in Fig. 1, the color and floral form of *S. formosissima* dominated in the hybrid flowers, a not unexpected result since bulbs of *S. formosissima* were many times larger than *Z. traubii*. When these bulbs began blooming, the author began experimenting by attempting to hybridize *xSprekelianthes* bulbs as both seed and pollen parents with other Amaryllid bulbs. Seldom were these crosses successful in yielding seeds that germinated and survived; several crosses yielded seeds that did not germinate. (As <5% of such crosses result in fertilization, non-germinating or non-viable seeds become a frustrating issue.)

An accounting of the successful hybrid crosses follows, including photographic illustrations.

### BACKCROSSES

On two different occasions, once in 2009 and once in 2010, pollen of *xSprekelianthes* was applied to *Zephyranthes traubii* (*Cooperia traubii*), eventually yielding one bulb in the former and three bulbs in the latter.

**Backcross** = *Zephyranthes traubii* ♀ x *xSprekelianthes* ♂

All bulbs bloomed in approximately a year from seed, and there was quite



**Fig. 1.** *xSprekelianthes* = *Zephyranthes traubii* x *Sprekelia formosissima*.

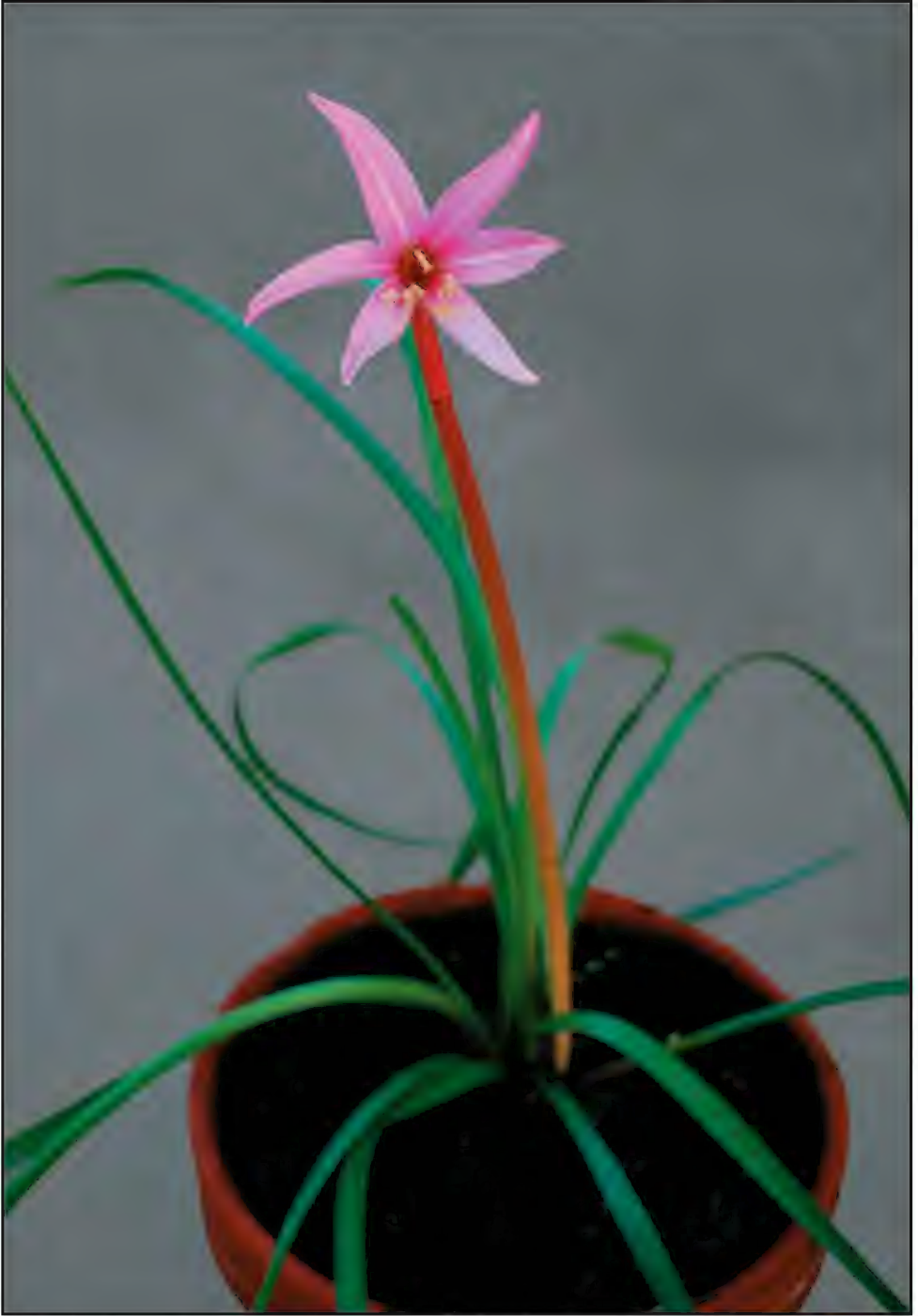
a bit of variation in the floral forms (Fig. 2, 3, 4, 5). With the genetic contribution of *Z. traubii* now assumed to be 75% in these backcrosses, there was clear dilution of the *Sprekelia* component.

The initial backcross bulb from 2009 (Fig. 2) bloomed in 2010 and eventually proved to be seed fertile. Seed fertility occurred when *Z. traubii* pollen was applied to its stigma, yielding four bulbs when this cross was accomplished in 2011.

**Back-Backcross** = [*Zephyranthes traubii* x *xSprekelianthes*] ♀ x *Z. traubii* ♂

The presumed genetic contribution of *Z. traubii* now was 87.5%. Three of the bulbs bloomed in 2012. In two of the bulbs (Fig. 6, 7), rust-red coloration continued in the scape but only soft pinkish bands remained on the dorsal three outer petals; the flower pattern was distinctly *Zephyranthes*, resembling the pattern of *Z. traubii* with a long style and short filaments clustered at the base of the style, although the pollen was yellow colored (rather than cream colored as in *Z. traubii*). In the third bulb (Fig. 8), only scant rust-red coloration was evident in the proximal scape and the flower petals were entirely white. However, the filaments were spread and long while the style was extremely short and buried in the throat, a reversal of

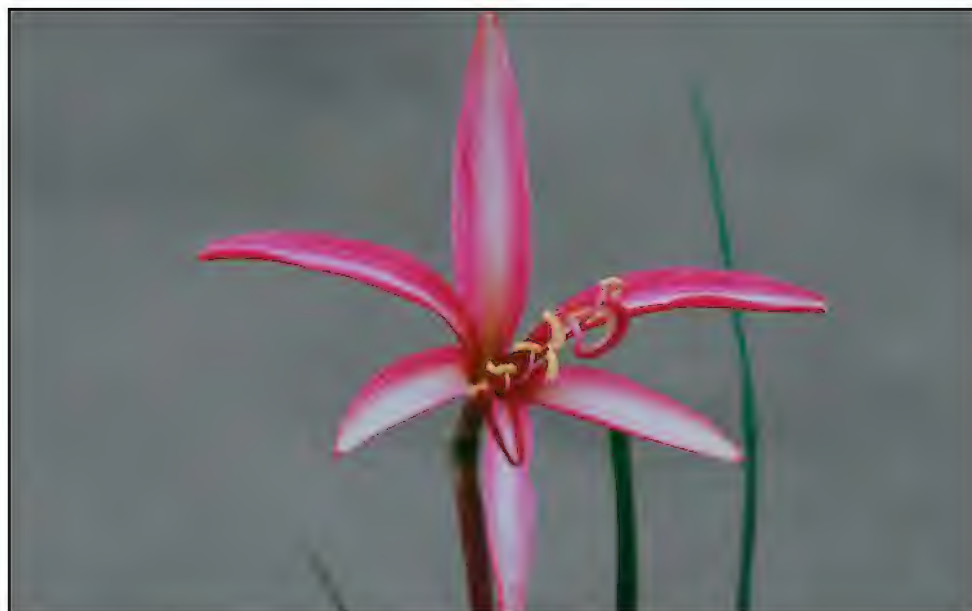




**Fig. 2.** *xSprekelianthes* Backcross (2009) = *Zephyranthes traubii* x *xSprekelianthes*.



**Fig. 3.** *xSprekelianthes* Backcross (2010) = *Zephyranthes traubii* x *xSprekelianthes*.



**Fig. 4.** *xSprekelianthes* Backcross (2010) = *Zephyranthes traubii* x *xSprekelianthes*.



**Fig. 5.** *xSprekelianthes* Backcross (2010) = *Zephyranthes traubii* x *xSprekelianthes*.

sorts – again the pollen was yellow.

On one occasion in 2006, a *xSprekelianthes* flower was fertilized with *S. formosissima* pollen, yielding an apparent successful backcross as multiple well-formed seeds were produced. However, the seeds did not germinate.

#### OUTCROSSES

A successful instance of seed fertility in *xSprekelianthes* occurred in an outcross:

**Outcross #1** = *xSprekelianthes* ♀ x *Sprekelia howardii* ♂

Only one bulb resulted from this cross in 2005, and with two different species of *Sprekelia* present in this complex hybrid, the floral pattern was nearly intermediate between the two *Sprekelia* species (Fig. 9), the notable difference being the more divergent lower two petals bordering each side of the central lowest petal. As evident in the latter photograph taken in 2012, the bulb had commenced offsetting and formed a small cluster of bulbs.

Pollen from Outcross #1 proved fertile as it was successfully applied to the *xHippeastrelia* Outcross illustrated in 2010 (Fig. 3 in Lehmillier, 2010), yielding a complex intergeneric hybrid between *Zephyranthes*, *Sprekelia* and

*Hippeastrum*, a new variation of *xHowardara* Lehmiller (2010). Only one bulb resulted from this cross and it bloomed for the first time in 2012 (Fig. 10).

***xHowardara* Variation** = [*xHippeastrelia* Outcross] ♀ x  
[Outcross #1] ♂

The parentage of the *xHippeastrelia* Outcross was:

[*Sprekelia formosissima* x *Hippeastrum* 'Hercules'] ♀ x *S. howardii* ♂

So the seed and pollen parents in this *xHowardara* Variation were each composed of an assumed 75% *Sprekelia* genetic composition, resulting in a flower with distinct *Sprekelia* overtones but clearly unique.

A second instance of seed fertility in *xSprekelianthes* occurred in 2012, being too immature to have bloomed as of this writing. Only one seedling germinated and survived from this outcross, its leaf color unlike *xSprekelianthes* and verifying hybridity.

**Outcross #2** = *xSprekelianthes* ♀ x *Habranthus robustus* ♂

This outcross, being a new trigeneric hybrid involving *Zephyranthes*, *Sprekelia* and *Habranthus* deserves a new taxonomic name = *xSprehabranthes*. That it could be accomplished is not surprising for two obvious reasons:

- 1) *Sprekelia* successfully has been crossed with *Habranthus*, *xSprekanthus* Traub (1969); in fact, the specific bigeneric hybrid reported in the latter, *xSprekanthus cagei*, consisted of the cross *Sprekelia formosissima* ♀ x *Habranthus robustus* ♂, two of the three bulbs utilized in this new trigeneric hybrid.
- 2) The bigeneric hybrid between *Zephyranthes* and *Habranthus*, *xZephybranthus* Howard (1990), has a long history of multiple reported hybrids, previously known under the illegitimate name *xSydneya* Traub (1954).

***xSprehabranthes*** Lehmiller, Trigeneric hybrid between the genera *Sprekelia* Heist., *Zephyranthes* Herb. and *Habranthus* Herb. [*Sprekelia formosissima* (L.) Herb. ♀ x *Zephyranthes traubii* (Hayw.) Mold. ♂] ♀ x *Habranthus robustus* Herb. ex Sweet ♂.





**Fig. 6.** *xSprekelianthes* Back-Backcross = [*Zephyranthes traubii* x *xSprekelianthes*] x *Z. traubii*.



**Fig. 7.** Close up of *xSprekelianthes* Back-Backcross flower in Fig. 6.



**Fig. 8.** Close up of different *xSprekelianthes* Back-Backcross flower.

## PENDING

In 2012, pollen of *S. howardii* was applied to *Z. traubii*, yielding multiple small, very slender black seeds. Surprisingly, three of these seeds germinated, yielding leaves with a glossy green color quite unlike *Z. traubii* and which soon exceeded the width of *Z. traubii* leaves, indicating they were indeed hybrids. These will provide an entirely new and smaller *xSprekelianthes* with which to pursue additional hybridizing opportunities in the future, likely commencing in 2013.

***xSprekelianthes* New** = *Zephyranthes traubii* ♀ x *Sprekelia howardii* ♂

**All photographs by the author**

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**Fig. 9.** *xSprekelianthes* Outcross #1 = *xSprekelianthes* x *Sprekelia howardii*.



**Fig. 10.** *xHowardara* Variation (see text).



### MUSINGS IN INTERGENERIC HYBRIDS – 3. A NEW NOTHOGENERIC TAXON: *xCRINETES*, AND NEW *xCRIMOCHARIS* HYBRIDS WHICH HAVE FLOWERED SINCE 2010 (AMARYLLIDACEAE)

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Lehmiller (2010) reported a series of new interspecific *Ammocharis* hybrids, new *xCrimocharis* hybrids, and new intergeneric hybrids involving *Crinum baumii* and *Cybistetes longifolia*. Some of the hybrids listed had not yet flowered when the article was published. The purpose of this report is to illustrate the new hybrids which have flowered since 2010 and to delineate a new nothogeneric taxon.

#### NEW NOTHOGENERIC TAXON: *xCRINETES*

In 2009, the author applied pollen of *Cybistetes longifolia* to *Crinum baumii*, yielding two hybrid bulbs as previously reported (Lehmiller, 2010). In June 2012, one of the bulbs flowered (Fig. 1), exhibiting a delicate 5-flowered umbel of light-pink tinged flowers, all flowers blooming simultaneously. On day two, the flower petals turned distinctly pink (Fig. 2), a similar senescent change noted in both parent taxa.

#### *xCrinetes* Lehmiller, **nothogen. nov.**

Bigeneric hybrid between the genus *Crinum* L. and the genus *Cybistetes* Milne-Redh. & Schweick.

Holotype: *Crinum baumii* Harms ♀ x *Cybistetes longifolia* (L.) Milne-Redh. & Schweick. ♂, ex hort., June 19, 2012, Lehmiller 1967, TAMU. (Fig. 1-3).

During the afternoon prior to anthesis, a heavy rainfall occurred with high winds, rendering it difficult to appreciate the disturbed leaf arrangement in Fig. 1. When leaves first appeared following dormancy and during their subsequent growth, they were aligned in a distichous pattern but were not biflabellately arranged as in *Ammocharis*. Individual leaves remained mildly channeled through their development, again inconsistent



**Fig. 1.** *xCrinetes* = *Crinum baumii* x *Cyristetes longifolia* in bloom, day one.



**Fig. 2.** *xCrinetes*, same flowering umbel as Fig. 1, day two. The flower petals have acquired a deep pink coloration.



**Fig. 3.** Type specimen of *xCrinetes*, Lehmillier 1967, TAMU.

with the usual pattern in *Ammocharis*. (Note: Leaves of *Ammocharis nerinoides* (Baker) Lehmiller are mildly channeled, an exception.)

Lehmiller (2007, 2010) has argued that many morphologic features of *Cybistetes* are too unique and too differing from the genus *Ammocharis*, and that *Cybistetes* should remain as a monotypic genus as delineated by Milne-Redhead & Schweickerdt (1939). *Crinum baumii* also has features inconsistent with the genus *Ammocharis* in the author's assessment (Lehmiller, 2010), and it should remain within the genus *Crinum* or possibly be assigned to a new monotypic genus.

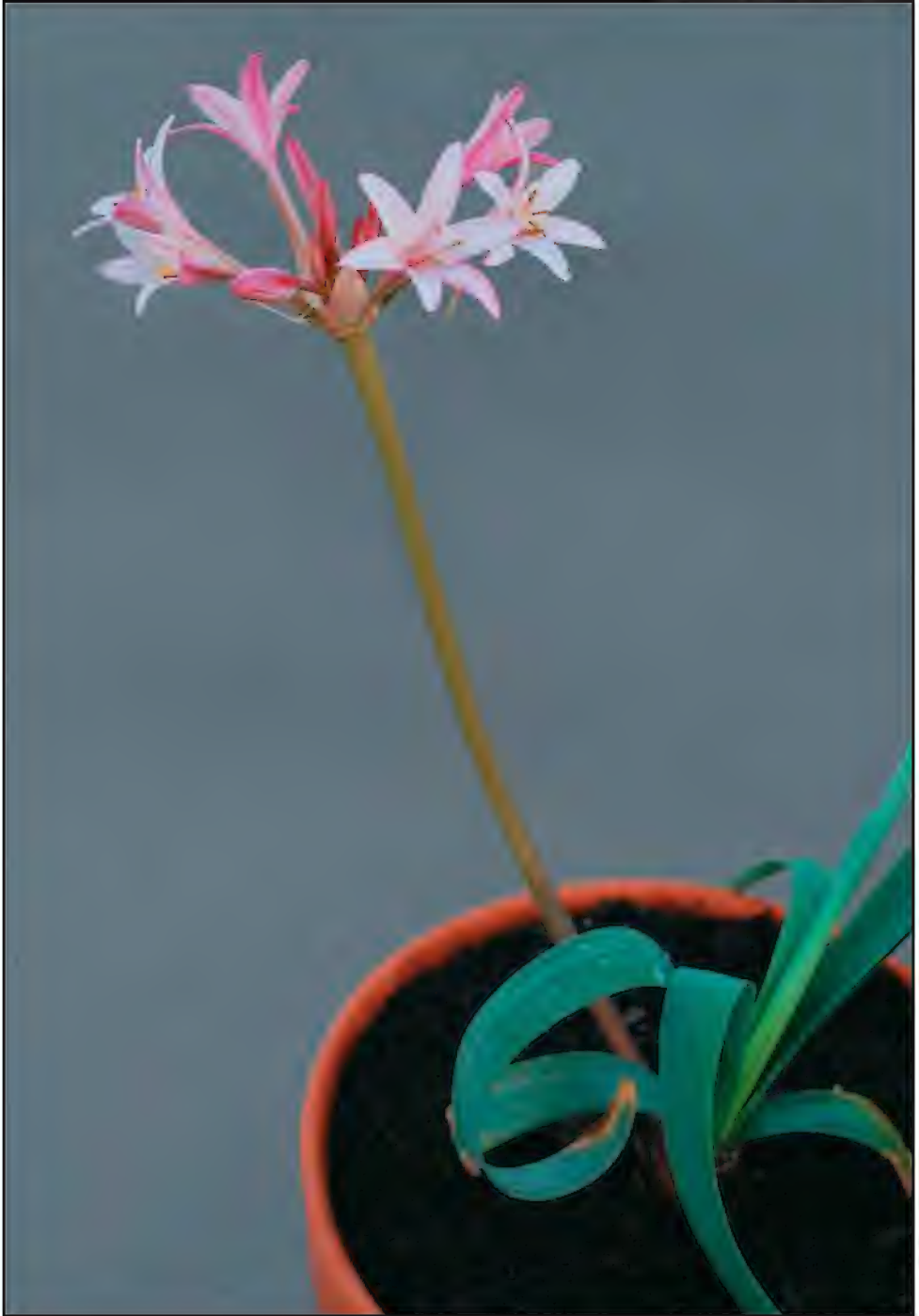
Unfortunately with only one bulb blooming, it was not possible to evaluate as to whether or not the new nothogeneric taxon possessed seed fertility and hence the seed-dispersal apparatus found in *Cybistetes* (the scape was utilized to make a herbarium specimen). A solitary attempt at a backcross with pollen applied onto *Crinum baumii* did not yield seeds.

#### NEW *xCRIMOCHARIS* HYBRIDS

- 1) *Ammocharis nerinoides* ♀ x *Crinum modestum* ♂ (Fig. 4, 5). Only one bulb resulted from this 2007 cross. Each leaf of this bulb clasps and partially encircles the adjacent younger leaf in the pattern of genus *Crinum*, but the clasping is very pronounced and leaves tend to remain adherent to one another well above the base of the plant, somewhat resembling a false pseudostem. Although quite attractive and striking, the flowers are rather small and not at all intermediate in size between the two parents.
- 2) *Crinum baumii* ♀ x *Ammocharis tinneana* ♂ (Fig. 6). Only one bulb resulted from this 2009 cross. Leaves of this bigeneric hybrid are distichous and biflabellately arranged, with only a slight channeling effect.
- 3) *Ammocharis nerinoides* ♀ x *Crinum hanitrae* ♂ (Fig. 7). Five bulbs resulted from this 2008 cross, three of which bloomed in 2012. The leaves are shiny green, similar in color to interspecific *Crinum* hybrids involving *C. hanitrae*.

**All photographs by the author**





**Fig. 4.** *xCrimocharis* = *Anmocharis nerinoides* × *Crinum modestum*.



**Fig. 5.** *xCrimocharis*, close-up of flowering umbel in Fig. 4.



**Fig. 6.** *xCrimocharis* = *Crinum baumii* x *Ammocharis tinneana*.



**Fig. 7.** *xCrimocharis* = *Amموcharis nerinoides* x *Crinum hanitrae*.

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## **CRINUM PROCERUM HYBRIDS BY AL BAUMAN**

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### **CRINUM PROCERUM HYBRID ‘TIMELESS SPLENDOUR’**

This is a cross of *Crinum procerum* (seed parent ) possibly involving *Crinum* ‘Summer Nocturne’ as the pollen parent that was made by Al Bauman (deceased) – at one time in the remote past Al and I had discussed crossing *Crinum* ‘Summer Nocturne’ with *Crinum procerum*. This new hybrid has been christened *Crinum* ‘Timeless Splendour’. Figure 1 shows *Crinum* ‘Timeless Splendour’ blooming during the summer of 2012. Figure 2 shows a mature plant of *Crinum* ‘Timeless Splendour’ in the summer of 2012, a 5 year old plant grown from a tiny offset removed from the original mother bulb. My plant has produced 4 offsets since it was planted in the ground 4 years ago. Figure 3 shows *Crinum* ‘Timeless Splendour’ blooming in January 2013 when the ambient temperature was 24°F, now with a much darker pigmentation. Figure 4 shows *Crinum* ‘Timeless Splendour’ in January 2013, surviving numerous days of 24°F with no evidence of leaf damage – the leaves were so big and heavy they had begun bending over.

To the best of my knowledge, this is one of the most stunning, bicolor *Crinum procerum* hybrids ever to surface. This 5 year old plant is 6 ft in height, having produced 7 scapes in 2012. Scapes are 48 inches long and green in color. Spathe bracts are green, 5 inches in length, and there are 22 to 25 blossoms per umbel. Tepal segments are 1 inch wide and 4 inches in length. Blossoms are pink/rose, with a white center and green eye, and they are 7 to 8 inches across. Various blossoms in the umbel display 6, 7, and up to 10 tepals. Figure 5 shows a blossom with 10 tepals that measures 8 inches across in diameter. Leaves are up to 56 inches long and 5 inches in width at the middle, taper to a blunt point, are green in color, number 30 at present, and have a pronounced depressed midrib. This plant has an elevated basal stump that is approximately 4 inches in diameter. The original mother plant is now 9 years old and growing in a 20 gallon container, and it is only 3 ft in height. We have had temperatures locally as low as 22°F with no apparent leaf damage. It is still blooming as



of January 31, 2013, having survived a week of 24°F temperatures. This *Crinum* hybrid does not seem to be bothered by hot summer sun or by freezing temperatures in my area. It likes frequent deep watering during the summer months. I fertilize it once a year with an eight month time-release fertilizer.

#### AL BAUMAN *CRINUM PROCERUM* HYBRID CROSSES

I currently am growing 5 of Al Bauman's *Crinum procerum* hybrids. These should easily be recognized as some of the finest breeding ever done with *Crinum procerum*. Al spent over 30 years breeding *Crinum procerum* hybrids exclusively. These 5 hybrids are:

1. *Crinum* 'Timeless Splendour' (Fig. 1-5)
2. *Crinum* 'Christina Bauman' (Fig. 6)
3. *Crinum* 'Inspiration'
4. *Crinum* 'Captivating' (Fig. 7)
5. *Crinum* unnamed

Figure 5 shows *Crinum* 'Christina Bauman'. Another beautiful cross by Al Bauman is *Crinum* 'Captivating' (Fig. 6), having a dark rose colored flower. This latter hybrid reaches 5 to 6 ft in height and is stunning when in bloom. All Al Bauman's *Crinum procerum* hybrids have an elevated basal stump, which is characteristic of the *Crinum procerum* group. Blossoms reach approximately 7 to 8 inches across on most Al Bauman *Crinum procerum* hybrids. Leaves are 5 and 6 inches in width, green in color, and approximately 56 inches in length, with a pronounced depressed midrib. Another Al Bauman hybrid is *Crinum* 'Inspiration', having a dark rose colored flower; this plant also reaches 5 to 6 ft in height and has large leaves with the same measurements as *Crinum* 'Captivating'. These huge *Crinums* make an imposing tropical statement in any landscape, and they represent a living tribute to Al Bauman's lifetime of work in breeding with *Crinum procerum*.

**All photographs by the author**



**Fig. 1.** *Crinum* 'Timeless Splendour' blooming the summer of 2012.



**Fig. 3.** *Crinum* 'Timeless Splendour' blooming following a cold spell, January 31, 2013.



**Fig. 2.** *Crinum* 'Timeless Splendour' mature 5 year old plant, summer of 2012.





**Fig. 4.** *Crinum* 'Timeless Splendour' showing huge mature leaves.





**Fig. 5.** *Crinum* 'Timeless Splendour' blossom 8 inches in diameter, with 10 tepal segments.



**Fig. 6.** *Crinum* 'Christina Bauman'.



**Fig. 7.** *Crinum* 'Captivating'.

## CRINUM 'CHARISMA'

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*Crinum* 'Charisma' is a beautiful new hybrid by Tom Perry of Orange Park, Florida. Perry originally made the cross:

*Crinum bulbispermum* var. *roseum* (seed parent)  
x *Crinum scabrum* (pollen parent)

A seedling of this hybrid cross bloomed within 5 years, and Perry gave it the name *Crinum* 'Pink Floyd'. Fifteen years ago Perry gave me the gift of an unbloomed seedling from *Crinum* 'Pink Floyd' which was growing in a 4 inch plastic container. Years later when this crinum seedling bloomed for the first time, I was shocked at its beauty and the large size of its blossoms. I then gave it the name of *Crinum* 'Charisma'. The photo (Fig. 1.) does not capture the beauty of its huge blossoms. When walking through the garden, you stop dead in your tracks (40 feet away) in awe of the huge blooms. Individual blossoms are 7 inches in diameter and have a very heavy substance. *Crinum* 'Charisma' sets an occasional seed. Tepal segments are 2½ to 3 inches in width; the spathe valve is 7 to 8 inches in height; scapes reach approximately 4 to 5 feet in height and are self supporting; leaves are 6 inches in width and approximately 4 feet in length, being grass green in color. Bulbs have reached 8 inches in diameter in 15 years. A mature plant is between 3 to 5 feet in height. *Crinum* 'Charisma' is a spectacular accent in the garden. It is reasonably hardy and has survived 22-24°F with no damage in Riverside, California.

**Fig. 1.** *Crinum* 'Charisma' in the author's garden.





## CHARLES CRAIB, IN MEMORIAM

Long time IBS member Charles Craib passed away unexpectedly on Monday, March 19, 2012. Charles's field articles from South Africa and Namibia were regular features in *Herbertia*; he was the most prolific contributor to *Herbertia* during the period from 1996 through 2010. Charles did not contribute any articles for the 2011 *Herbertia* due to his commitment to complete a book with IBS member John Lavranos entitled "The Bushman Candles". The latter was published during 2011.

We have been fortunate to obtain a few photographs of Charles that were taken by Connall Oosterbroek – Connall's photography frequently adorned Charles's articles in *Herbertia* – which are illustrated as a tribute to Charles. In further recognition of Charles, a listing of all his *Herbertia* publications in chronologic order is provided following the photographs.

### All photographs by Connall Oosterbroek







**PUBLICATIONS BY CHARLES CRAIB IN HERBERTIA**

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## GARY HAMMER, IN MEMORIAM

July 31, 1954 – August 7, 2011

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I first met Gary Hammer in the mid 1970's through William 'Bill' T. Drysdale. Bill and I would travel to Gary's Glendale Paradise Nursery, in Glendale, California (Gary later moved this nursery to Lake View Terrace, California) and to his retail outlet, Desert To Jungle Nursery in Montebello, California. We made many wonderful trips over the years and brought back truckloads of botanical treasures. Gary, Bill and I became close friends over time and shared many rare plants between us. Gary built a home in Orizaba, Mexico, along with a nursery to propagate his plants at 5,000 feet elevation, near Pico de Orizaba. (Pico de Orizaba is the highest mountain in Mexico, and it is the third highest peak and tallest volcano in North America.) Gary loved plant exploring and collecting with a passion, especially in Mexico. The allure of searching for botanical treasures was the love of his life. He also traveled to Australia, Brazil, Greece, New Zealand, South Africa and Thailand. Upon his return from these distant places, there would always be a bountiful harvest of rare plants to propagate. Gary discovered and introduced many new varieties of plants to the horticultural trade. Many old varieties lost in the trade were also rediscovered by Gary and reintroduced.

On one of his trips to Durban, South Africa, Gary discovered a beautiful, multihued variegated *Canna*, which he named *Canna* 'Durban'. Gary called me and asked if I would propagate this *Canna* at my nursery in Sanger, California, and introduce it to the horticultural world. There was no hesitation on my part. In one year I had propagated *Canna* 'Durban' in sufficient numbers that permitted us to begin distribution to collectors and *Canna* enthusiasts worldwide. The latter became obsessed with the possibility of acquiring this rare new discovery, and it was an overwhelming success.

I shall always remember a call I received one summer day while working in my nursery in Sanger, California. Gary called to tell me that he had



**Fig. 1.** Gary Hammer in Greece. (Photo by Karen Hammer)

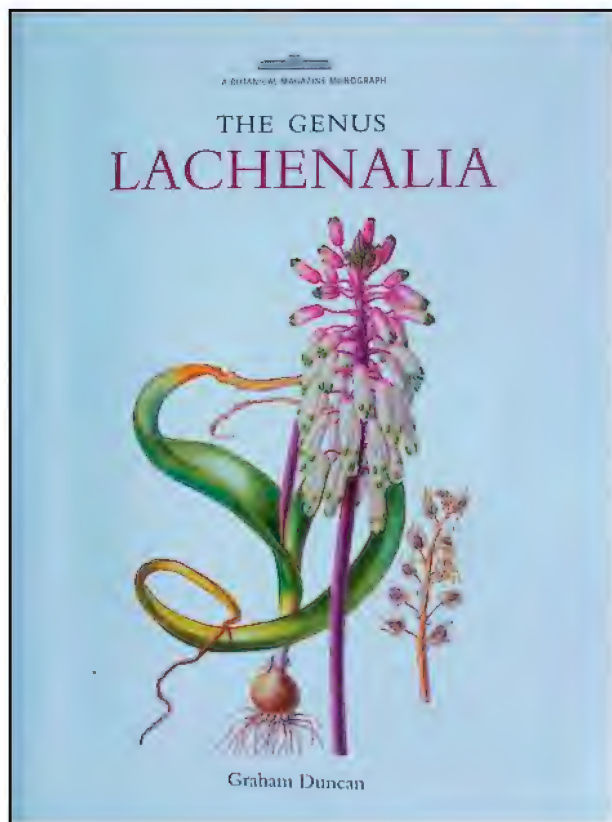
discovered an unknown variety of *Hymenocallis* while plant hunting in Mexico. He asked me if I could help him identify the plant. I said: "Yes, of course", and I waited with anticipation for him to send the bulbs to me. I received three bulbs from Gary the following week and planted them immediately. Approximately a month later when they had leafed out, I thought he had sent me bulbs of *Eucharis amazonica* (the Amazon Lily). I called Gary and told him this is what it looked like to me. Gary said: "No Herb. It has *Hymenocallis* type blossoms on it." When it finally bloomed, I could not believe my eyes. My heart was racing with excitement, because now I could identify this beautiful *Hymenocallis*. After researching through Dr. Hamilton P. Traub's notes and old files, pictures, etc., I had verified my thoughts. Gary had discovered the long lost colony of *Hymenocallis eucharidifolia* in Mexico. The origin of this colony had been shrouded in a cloud of mystery for over one hundred and fifty years. Occasionally a plant of *Hymenocallis eucharidifolia* would appear mixed in with other collected plants, but always, no one knew its origin. I called Gary and told him he had discovered the long lost colony of *Hymenocallis eucharidifolia* in Mexico. Gary said: "Are you sure of this Herb?" I said: "Gary, there is no doubt in my mind." Gary then let out a loud yell of excitement over the phone. Thanks to Gary finding this colony of *Hymenocallis eucharidifolia*, I later wrote the first major account of this long lost botanical treasure ever published, showing a cross section of the plants and their variability throughout the colony in Mexico. This was published in *Herbertia* 59:37-71, 2004-2005 and entitled: The elusive *Hymenocallis eucharidifolia* Baker (Amaryllidaceae). I feel honored that I was a part of introducing plants of this very rare, long lost botanical treasure to the horticultural world for Gary.

On Saturday August 6, 2011, a tragedy occurred. Gary was in Tempe, Arizona because his flight to Mexico had been cancelled. He had walked to a nearby Denny's Restaurant to have dinner. While walking across the street late that evening, he was struck by a car and died the following morning (August 7, 2011). The botanical world had lost a great friend. Gary, thank you for all the wonderful years of your friendship which I shall cherish forever. All the great times and all the fabulous plants you brought me throughout the years as gifts will always be treasured. My life has been enriched by your friendship. You have left the plant world a great legacy by having lived. You will be missed my special friend, but you will never be forgotten.



#### ACKNOWLEDGEMENTS

Special thanks and gratitude to Florence Hammer for supplying information needed for this article, and to Karen Hammer for supplying the great picture of Gary Hammer.



***Botanical Magazine***

***Monograph:***

***THE GENUS***

***LACHENALIA***

**Author: Graham**

**Duncan\***

**(\*2001 Herbert Medalist**

**– see Herbertia 59:12-17)**

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**BOOK REVIEW**

**by Rhoda and Cameron McMaster**

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The exquisite watercolour paintings of *Lachenalia sargeantii* and *L. violacea* on the front and back of the dust jacket compel one to open the book! And you will not be disappointed. This long-awaited comprehensive monograph of the Southern African genus *Lachenalia* by Graham Duncan, specialist horticulturalist at the Kirstenbosch Botanical Gardens, reveals all there is to know about *Lachenalia* in 2012. Duncan has put together many years of research and study of the genus, be it in the field, the nursery, library or laboratory, together with extensive information on the history, biology, habitat and cultivation. With over 300 clear colour photographs, 39 beautiful watercolour paintings and several line drawings, it is also a delight to page through.

The previous *Lachenalia* monograph with 42 species was written by Baker, published in 1897 in *Flora Capensis*. Now there are 133 species, ten of which are new taxa and one new subspecies published here for the first time. Duncan's *The Lachenalia Handbook* (1988) can now be put to rest on the shelf with other botanical Africana books.

There are six chapters, an extensive and comprehensive reference list, three pages of glossary, a general index and an index of scientific names.

The HISTORY chapter starts with the 1685/6 expedition of Simon van der Stel to Namaqualand and the resulting first watercolour painting of *L. hirta* in 1685. The contributions of botanists, scientists, illustrators and horticulturalists are discussed – amongst others Nicolaus Joseph Jacquin, Carl Linnaeus junior, John Gilbert Baker, Rudolph Schlechter, Charles Darwin and Winsome Barker. The genus was named *Lachenalia* in 1780 by Joseph Franz von Jacquin (son of N.J. above) when he was only 14 years old, after the Swiss botanist and chemist, Professor Werner de Lachenal.

CULTIVATION AND PROPAGATION includes detailed information covering pot culture and landscape uses, aspect, growing medium, planting, watering and even burning (for the three fire-stimulated species). There are various lists such as of species suited to colder climates, dry areas, wet areas, pots or garden, for cut flowers and the scented species. Seed production and germination, vegetative reproduction by bulblets, bulbils and leaf cuttings, are followed by suggested methods for the control of the more important pests and diseases of *Lachenalia*.

The third chapter, LACHENALIA AND THE ENVIRONMENT, is divided into Conservation, Phytogeography (distribution and speciation), Ecology and Habitat, Adaptive Strategies (surviving the dormant period, defense against predators), and Phenology with a table of flowering months for every species.

LACHENALIA BIOLOGY includes four sections: Morphology, Pollination Biology, Seed Dispersal, and Karyology. Morphology, illustrated with clear line drawings and scanning electron micrographs, is covered in 23 pages – essential information seeing that this monograph is largely based on plant features. Duncan states that despite “the high level of morphological variation within certain species of *Lachenalia* ... most species are distinct and easily identified.” The micrographs of leaf trichome morphology (hairs on the leaves) and the upper leaf and leaf margin micromorphologies show an amazing hidden world of patterns

and shapes. Micrographs of the variations in seed shapes, testa sculpturing and strophiole length are likewise an eye-opener. Excellent line drawings depict the variations in inflorescence type, in perianth shape and filament orientation. Floral structure, colour and fragrance are the primary attractions for a variety of insect pollinators, ranging from bees, beetles, flies, and butterflies to moths, with sunbirds visiting long-tube species, and rodents being possible pollinators of two yeast-scented species. Some seeds are carried away by ants.

PHYLOGENY covers the evolutionary development of *Lachenalia*. Numerous studies are cited to support the inclusion of the genus *Polyxena* within *Lachenalia*.

The sixth chapter, TAXONOMIC TREATMENT, provides a very comprehensive treatment of the 133 species recognized by Duncan, with a key that is easy to follow, and clear individual distribution maps. The subgenus *Lachenalia* contains 124 species divided into five sections, based on five major perianth shapes (line drawings p. 72), while the second subgenus *Polyxena* contains seven species (one being new).

Each species is dealt with under the headings: Etymology, Description, Flowering Period, History, Distinguishing Characteristics and Affinities, Distribution and Habitat, and where relevant, the Conservation Status, and finally, Notes, where additional information is included.

As in most monographs, there is some ‘lumping’ and ‘splitting’ of species; for example, *Lachenalia aloides*, well known up to now for several different forms, varieties and colour combinations, has been separated into seven different species, plus one new species that Miss Barker had intended to describe as a variety of *L. aloides*; the old *Lachenalia elegans* varieties have been separated into four different species; and on the ‘lumping’ side, *Lachenalia pallida* now includes *L. pustulata*, *L. gillettii* and *L. unicolor*.

The title could just as easily have been “The *Lachenalia* Encyclopedia”. We recommend this book very highly.

### **All subsequent photographs by Cameron McMaster**

EDITOR’S NOTE: Cameron McMaster has provided a sampling of *Lachenalia* field photographs to supplement this review, one of which includes the author, Graham Duncan.





**Fig. 2.** Graham Duncan with *Lachenalia sargeantii*, Napier, October 22, 2006.



**Fig. 3.** *Lachenalia zebrina* in habitat, Tanqua Karoo, September 4, 2006





**Fig. 4.** *Lachenalia nervosa*, Skurwekop, Napier, October 22, 2006.





**Fig. 5.** *Lachenalia orchiooides* subsp. *orchiooides*, Fairfield, Napier, September 8, 2007. This figure is published in Duncan's book.



**Fig. 6.** *Lachenalia violacea*, Ceres Karoo, September 3, 2006.



**Fig. 7.** *Lachenalia sargeantii*, Fairfield, October 24, 2007.





**Fig. 8.** *Lachenalia juncifolia*, DeHoop, August 27, 2012.

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The above individuals made donations to the IBS Seed & Bulb Exchange and/or to various IBS Funds during calendar year 2012. THANK YOU!

Herbert Kelly Jr.  
President

The IBS Seed & Bulb Exchange (SX & BX) has been a major source of funding in recent years – without it the Society would have succumbed years ago. The Director of the Seed and Bulb Exchange, Herbert Kelly Jr., working in conjunction with the Treasurer, Pam Kelly, have compiled listings of the individual seed and bulb offerings in the SX & BX during the period 2002 through 2012; these alphabetized lists follow. All duplications and recurrent offerings have been omitted. (Any omissions or misspellings are unintentional.)

## BX OFFERINGS 2002 THROUGH 2012

- Albuca angolensis*  
*Albuca canadensis*  
*Albuca 'Maxima'*  
*Albuca shawii*  
*Allium 'Hair'*  
*Alocasia brisbanensis*  
*Alocasia macrorrhiza*  
*xAmarcrinum Corsii* 'Fred Howard'  
*Amaryllis belladonna* (mixed colors)  
*Amaryllis belladonna x Brunsvigia josephinae*  
*Ammocharis nerinoides* (Namibia)  
*Ammocharis nerinoides x Ammocharis coranica*
- Babiana villosa*  
*Bomarea edulis* tubers  
*Boophana disticha*  
*Brunsvigia josephinae*
- Caladium bicolor* tubers (green leaf/wine red spots)  
*Caladium tubers* (pink/gray leaves)  
*Caladium tubers* (silvery leaf form)  
*Canna 'Endeavour'*  
*Canna glauca*  
*Canna imaculata* rhizomes  
*Clivia 'Elegant Moon'* (Solomone)  
*Clivia 'Fourth of July'* (Solomone)  
*Clivia 'Irmas Choice'* (Solomone)  
*Clivia 'La Sonrisa De Raquel'* (Solomone)  
*Clivia 'Little Charm'* (Solomone)  
*Clivia 'Little Charm Yellow'* (Solomone)  
*Clivia 'Maricela's Choice'* (Solomone)  
*Clivia miniata*  
*Clivia orange variegated* (Solomone)  
*Clivia orange flowers* (Solomone)  
*Clivia yellow* (Solomone)  
*Clivia 'Yellow Charm'* (Solomone)  
*Colocasia 'Chicago Harlequin'*  
*Cooperia drummondii* (Texas)  
*Cooperia pedunculata*  
*Cooperia/Zephyranthes traubii*  
*Costus pictus* (red banded clone)  
*xCrimocharis hardyi*  
*Crinum abyssinicum* (Ethiopia)  
*Crinum americanum* (Florida)  
*Crinum americanum x Crinum lugardiae*  
*Crinum angustifolium* var *darwinensis*  
*Crinum asiaticum*
- Crinum x baconii* 'Fourth of July'  
*Crinum x baconii* 'Maureen Spinks'  
*Crinum baumii* (Namibia)  
*Crinum 'Bayou Traveler'*  
*Crinum bracteatum* (Seychelles)  
*Crinum 'Bradley'*  
*Crinum broussonetti* (Tchad)  
*Crinum broussonetti x Crinum moorei*  
*Crinum broussonetti x (Crinum broussonettii x Crinum moorei)*  
*Crinum bulbispermum x C. oliganthum*  
*Crinum bulbispermum album*  
*Crinum bulbispermum* Orange River Basin  
*Crinum buphanoides* ('Transvaal')  
*Crinum campanulatum* (South Africa)  
*Crinum 'Carnival'*  
*Crinum 'Carolina Beauty'*  
*Crinum 'Claude Davis'*  
*Crinum carolo-schmidtii* (Namibia)  
*Crinum 'Cortez'* (Lehmiller)  
*Crinum cruentum* (Mexico)  
*Crinum distichum*  
*Crinum distichum x Crinum moorei*  
*Crinum 'Dwarf Pink'* (Hannibal)  
*Crinum 'Elegance'*  
*Crinum 'Elizabeth Traub'*  
*Crinum 'Ellen Bosanquet'* (wine rose)  
*Crinum 'Emma Jones'*  
*Crinum 'Enchantress'* (Lehmiller)  
*Crinum erubescens*  
*Crinum firmifolium* (Madagascar)  
*Crinum flaccidum* (Australia)  
*Crinum forbesii* (Namibia)  
*Crinum forbesii x Crinum acaule* (Natal)  
*Crinum forbesii x Crinum macowanii*  
*Crinum hardyi* (Madagascar)  
*Crinum hildebrandtii*  
*Crinum 'Improved Peach Blow'*  
*Crinum 'Infusion'*  
*Crinum 'International'*  
*Crinum 'J.C. Harvey'* [*C. carolo-schmidtii x (C. americanum x C. macowanii)*] x *Crinum moorei*  
*Crinum jagus* (semi-dwarf, East Africa)  
*Crinum jagus 'Scillifolium'*  
*Crinum jagus 'Rattrayi'*  
*Crinum 'John's Bid'* (Lehmiller)  
*Crinum 'Jubilee'*

- Crinum kirkii* (Tanzania)  
*Crinum* 'Kristin's Best Tan' (Lehmiller)  
*Crinum kunthianum* (Costa Rica)  
*Crinum* 'Lorraine Clark'  
*Crinum latifolium* (India)  
*Crinum latifolium* x *Crinum paludosum*  
*Crinum lavrani* x (*C. mccoysi* x *C. lavrani*)  
*Crinum ligulatum* (Madagascar)  
*Crinum loddigesianum* (Mexico)  
*Crinum* 'Long Shot'  
*Crinum lugardiae* (Namibia)  
*Crinum lugardiae* x *C. oliganthum* 'Lil Gal'  
*Crinum luteolum* (Pichi Richi, Australia)  
*Crinum macowanii* (Kenya)  
*Crinum* 'Marisco' (Veracruz, Mexico)  
*Crinum mauritianum* (Madagascar)  
*Crinum mccoysi* x *Crinum lavrani*  
*Crinum mccoysi* x *Crinum variabile*  
*Crinum* 'Menehune'  
*Crinum* 'Mexican Pink'  
*Crinum* 'Mother of Pearl' (Lehmiller)  
*Crinum moorei*  
*Crinum* 'Ms Nancy' (Lehmiller)  
*Crinum* 'Mystery'  
*Crinum oliganthum* (West Indies mini)  
*Crinum paludosum* Intraspecific Hybrid  
*Crinum paludosum* (Natal)  
*Crinum paludosum* x *Crinum erubescens*  
*Crinum pauciflorum* (Tchad)  
*Crinum* 'Peach Blow'  
*Crinum* 'Pink Perfume' (Lehmiller)  
*Crinum* 'Pink Trumpet'  
*Crinum* x *powellii*  
*Crinum pronkii* (Madagascar)  
*Crinum razafindratsiraea* (Madagascar)  
*Crinum* 'Regina's Disco Lounge'  
*Crinum* 'Sangria'  
*Crinum* 'Stars and Strips'  
*Crinum strictum* sensu Howard (Mexico)  
*Crinum* 'Summer Nocturne'  
*Crinum* 'Super Ellen'  
*Crinum* 'Talisman Hybrid' (Cameroun)  
*Crinum* 'Temptation'  
*Crinum* 'This is Outrageous'  
*Crinum uniflorum* (Northwest Australia)  
*Crinum variable*  
*Crinum* 'Vera Cruz' (Mexico)  
*Crinum* 'Walter Flory'  
*Crinum* 'White Fluff'  
*Crinum* 'White Prince'
- Crinum* x *worsleyi*  
*Crinum yuccaeides* (Cameroun)  
*Crinum zeylanicum* cultivar (Mexico)  
*Crinum zeylanicum* x *C. fimbriatulum*  
     'Forever Strips' (Lehmiller)  
*Crocus sativus*  
*Curcuma* sp. affinis *rubescens*  
*Cyclamen hederifolium*  
*Cypella coelestis*
- Drimiopsis kirkii*
- Eucomis comosa*  
*Eucomis vandermerwei* (South Africa)  
*Eustephia darwinii*  
*Eustephia kawidei*
- Freesia* (white, South Africa)
- Galanthus nivalis*  
Garlic bulblets  
*Gladiolus ceresianus*  
*Gladiolus* species (greenish blossoms)
- Habranthus* (Brazil)  
*Habranthus brachyandrus*  
*Habranthus robustus*  
*Habranthus texanus*  
*Haemanthus albiflos*  
*Haemanthus deformis* (South Africa)  
*Haemanthus humilis* ssp. *humilis* (giant form)  
*Haemanthus montanus*  
*Hedychium coronarium*  
*Hedychium* 'Daniel Weeks'  
*Hedychium* 'Kinkaku'  
*Hedychium* 'Maiko'  
*Hieronymiella marginata*  
x*Hippeastreli* 'Wilhelmina Prasek'  
*Hippeastrum aglaiae* x *H. brazilianum*  
*Hippeastrum aulicum*  
*Hippeastrum aulicum* var. *stenopetalum*  
*Hippeastrum aulicum* x *H. traubii*  
*Hippeastrum ambiguum* (Doran 1756D-185  
*Hippeastrum* 'Amoretta'  
*Hippeastrum* 'Benefica'  
*Hippeastrum cybister* x *H. papilio*  
*Hippeastrum blossfeldiae* (Doran Collect.)  
*Hippeastrum* 'Blossom Peacock'  
*Hippeastrum* 'Candy Floss'  
*Hippeastrum* 'Charmisa'



- Hippeastrum 'Confettii' (Doran 95)  
 Hippeastrum cybister (Doran 1159D-108)  
 Hippeastrum 'Double Queen'  
 Hippeastrum 'Double Record'  
 Hippeastrum EAE x H. parodii (Doran)  
 (Hippeastrum EAE x H. parodii) x  
     H. neopardinum  
 (Hippeastrum EAE x H. parodii) x (H. aglaiae x  
     H. brazilianum)  
 (Hippeastrum EAE x H. parodii) x self  
     (Doran hybrid)  
 Hippeastrum 'Fairy Tale'  
 Hippeastrum 'Firefly'  
 Hippeastrum flammigerum (Sahuc #4)  
 Hippeastrum 'Great Dutch LaForest'  
 Hippeastrum hybrid orange (name lost)  
 Hippeastrum 'Illusion'  
 Hippeastrum immaculatum (Doran 1864D-43)  
 Hippeastrum 'Jade Dragon' x H. 'Exotic Star'  
 Hippeastrum 'Jade Dragon' x H. 'Rio Negro'  
 Hippeastrum x johnsonii x H. papilio  
 Hippeastrum 'Lambada'  
 Hippeastrum lapacensis  
 Hippeastrum 'La Paloma'  
 Hippeastrum 'La Paz Chico'  
 Hippeastrum 'Lemon Lime' x H. neopardinum  
 Hippeastrum 'Lemon Star'  
 Hippeastrum 'Lime' x H. 'Jade Dragon'  
 Hippeastrum macchupichuensis  
 Hippeastrum mandonii (Bolivia)  
 Hippeastrum 'Minerva'  
 Hippeastrum 'Naughty Lady'  
 Hippeastrum neoleopoldii  
 Hippeastrum neopardinum (Doran)  
 Hippeastrum neopardinum x H. neoleopoldii  
 Hippeastrum neopardinum x H. papilio  
 Hippeastrum papilio  
 Hippeastrum papilio x H. cybister  
 Hippeastrum papilio x (H. cybister x H. papilio)  
 Hippeastrum parodii (Sahuc #8)  
 Hippeastrum 'Pink Impressions'  
 Hippeastrum 'Pink Star'  
 Hippeastrum puniceum (Peru)  
 Hippeastrum 'Ragtime'  
 Hippeastrum 'Red Lion'  
 Hippeastrum 'Red Lion Jumbo'  
 Hippeastrum reginae (Doran 1861D-219)  
 Hippeastrum 'Rilone'  
 Hippeastrum 'San Antonio Rose'  
 Hippeastrum 'Sweet Fairy Tale'  
 Hippeastrum 'Ruby Meyer'  
 Hippeastrum 'Trixie' x self  
 Hippeastrum vittatum var tweedianum x  
     H. ambiguum (Doran)  
 Hippeastrum 'White Christmas'  
 Hymenocallis acutifolia (Mexico)  
 Hymenocallis astrostephana (Mexico)  
 Hymenocallis azteciana (Mexico)  
 Hymenocallis caribea (Dominican Republic)  
 Hymenocallis caribean (dwarf)  
 Hymenocallis caribea 'Expansa'  
 Hymenocallis chiapasiana (Mexico)  
 Hymenocallis eucharidifolia (Mexico)  
 Hymenocallis franklinensis  
 Hymenocallis glauca (Mexico)  
 Hymenocallis harrisiana (Mexico)  
 Hymenocallis howardii (Mexico)  
 Hymenocallis lehmilleri (Mexico)  
 Hymenocallis lirosme (Sour Lake, TX)  
 Hymenocallis maximilianii (Mexico)  
 Hymenocallis palmeri  
 Hymenocallis pimana (Mexico)  
 Hymenocallis riparia  
 Hymenocallis species unknown  
 Hymenocallis speciosa (Barbados)  
 Hymenocallis 'Tropical Giant'  
 Hymenocallis tubiflora (Trinidad)  
 Iris setosa ssp (Central Alaska)  
 Ismene 'Festalis'  
 Ismene 'Zwanenburg'  
 Ixia viridiflora  
 Jerusalem artichoke (red)  
 Jerusalem artichoke (white)  
 Kniphofia 'Springtime'  
 Lachenalia aloides var pearsonii  
 Lachenalia aloides 'Quadricolor'  
 Lachenalia bulbifera  
 Lachenalia pustulata  
 Lachenalia rubida  
 Lachenalia 'Rupert'  
 Leucocoryne 'La Serena'  
 Lilium hybrid (mixed)  
 Lilium tigrinum  
 Macrozamia communis (Southern New  
     South Wales)

*Milla magnifica* (Mexico)  
*Mimosa albizzia julibrissin*  
*Moraea gigandra* (tricolor)  
*Musa velutina*

*Nerine* x *Amaryllis*  
*Nerine filifolia* (dwarf)

*Ornithogalum arabicum*

*Rauhia decora*  
*Remusatia vivipara* (tubers)  
*Rhodocodon species* (Madagascar)  
*Rhodophiala advenum*  
*Rhodophiala bifida*  
*Rhodophiala bagnoldii*  
*Rhodophiala phycelloides*  
*Romulea bulbosodiu* alba  
*Romulea crocea*

*Scadoxus multiflorus* ssp *multiflorus*  
 (NW Botswana)  
*Scilla scilloides*  
*Sprekelia formosissima* (East of San Luis  
 Potosi, Mexico)  
*Sprekelia formosissima* (West of Iguala, Mexico)  
*Sprekelia howardii*  
*Sprekelia* ‘Orient Red’  
*xSprekelianthes*  
*Spiloxene capensis*  
*Strelitzia alba*  
*Strelitzia juncea* (South Africa)

*Tecophilina cyanocrocus*  
*Tecophilina cyanocrocus* var *violacea*  
*Tecophilina cyanocrocus* var *leichtlini*

*Urceolina peruviana*

*Veltheimia bracteata*

*Watsonia pillansii* (apricot hybrid)

*Zephyranthes* ‘Bangkok Yellow’  
*Zephyranthes candida*  
*Zephyranthes chlorosen*  
*Zephyranthes citrina*  
*Zephyranthes drummondii*  
*Zephyranthes guatemalensis*  
*Zephyranthes* ‘Horse Tail Falls’

*Zephyranthes insularum*  
*Zephyranthes* ‘Joann Trial’  
*Zephyranthes macrosiphon*  
*Zephyranthes morrisclintii*  
*Zephyranthes mostezumae*  
*Zephyranthes* ‘Pamillas’ (Mexico)  
*Zephyranthes reginae*  
*Zephyranthes* ‘Sunset Strain’  
*Zephyranthes verecunda*

## SX OFFERINGS 2002 THROUGH 2012

- Albuca shawii*  
*Albuca* species (unknown)  
*Allium karataviense*  
*Allium neapolitanum*  
*Allium schubertii*  
*Allium triquetrum*  
*Alophia veracruzana*  
*Alstroemeria* hybrid  
*Alstroemeria longistaminea*  
*xAmarygia parkeri alba*  
*Amaryllis belladonna* (Bloemfontein)  
*Amaryllis belladonna* (Doran, deep rose)  
*Amaryllis belladonna* (Doran, mixed white)  
*Amaryllis belladonna* (pink)  
*Amaryllis belladonna* (mixed colors)  
*Amaryllis belladonna* (select hybrids)  
*Amaryllis belladonna* (white)  
*Amaryllis belladonna* x *Brunsvigia*  
*Ammocharis coranica*  
*Ammocharis nerinoides* (Namibia)  
*Ammocharis nerinoides* (seed parent) x  
*Ammocharis tinneana*  
*Ammocharis tinneana* (Zambia)  
*Amsonia*  
*Anomatheca laxa*  
*Aristea ecklonii*  
*Arum hygrophilum* (Araceae)  
*Arum purpureospathum*  
*Asclepias viridiflora* 'Green Milkweed'
- Bellevalia romana*  
*Brugmansia* (mixed colors)  
*Brunsvigia josephinae*  
*Bulbinella cauda-felis*  
*Butia capitata*
- Caesalpinia gilliesii* (Yellow Bird of Paradise)  
*Caesalpinia mexicana*  
*Calceolaria* sp.  
*Caliphruria korsakoffii* (Peru)  
*Calochortus* 'Golden Orb'  
*Calostemma luteum* (Maynes Lagoon,  
 NSW, Australia)  
*Calostemma luteum* (south of Cunnamulla,  
 QLD.)  
*Calostemma luteum* (Baan Baa, NSW)  
*Calostemma luteum* (south of Nyngan, NSW)  
*Campsis radicans*
- Canna* 'Endeavour' (Longwood Aquatic)  
*Canna* 'Erebus' (Longwood Aquatic)  
*Canna flaccida*  
*Canna glauca*  
*Canna indica*  
*Canna indica* var *maculata*  
*Canna* 'Intrigue' (H. Kelly Jr.)  
*Canna paniculata*  
*Canna* species  
*Canna* 'Tama-Tulipa'  
*Canna* 'Taney' (Longwood Aquatic)  
*Canna* 'RA' (Longwood Aquatic)  
*Canna warscewiczii*  
*Cassia alata* (*Senna alata*)  
*Cassia* species  
*Cercis canadensis*  
*Chasmanthe floribunda* var *duckettii*  
*Chilopsis linearis* 'Burgandy'  
*Chilopsis linearis* 'Grande'  
*Chilopsis linearis* 'Purple Splendour'  
 (H. Kelly Jr.)  
*Chilopsis linearis* 'Snowflurry'  
 (H. Kelly Jr.)  
*Clematis crispa*  
*Clematis glaucophylla*  
*Clianthus puniceus* (New Zealand)  
*Clitoria tamatea*  
*Clivia* 'Green Clouds' x MP-Y  
*Clivia nobilis*  
*Colchium autumnale*  
*xCoobranthus coryi*  
*Cooperia drummondii*  
*Cooperia* 'Giant Prairie Lily'  
*Cooperia pedunculata*  
*Cooperia/Zephyranthes traubii*  
*Crinum album*  
*Crinum americanum*  
*Crinum angustifolium* (Australia)  
*Crinum angustifolium* var *darwinensis*  
*Crinum aurantiacum* (Zambia)  
*Crinum baumii* (Namibia)  
*Crinum brachyandrum* (Seychelles)  
*Crinum broussonetii* (Tchad)  
*Crinum bulbispermum album*  
*Crinum bulbispermum album* (Oak Lawn  
 Cemetery)  
*Crinum bulbispermum* 'Checkmate' form of  
*C. bulbispermum album*

- Crinum bulbispermum* (Port Elizabeth, South Africa)  
*Crinum bulbispermum* 'Jumbo'  
*Crinum bulbispermum* 'Jumbo' hybrid (best red select)  
*Crinum bulbispermum* 'Jumbo' hybrid (green/white select)  
*Crinum bulbispermum* 'Jumbo' hybrid (select full flower/red keels)  
*Crinum bulbispermum* (L.S. Hannibal)  
*Crinum bulbispermum* (Orange River Basin, South Africa)  
*Crinum bulbispermum* roseum  
*Crinum bulbispermum* x *C. flaccidum*  
*Crinum bulbispermum* x *C. macowanii*  
*Crinum bulbispermum* 'White Bishop'  
*Crinum bulbispermum* (white/reddish)  
*Crinum buphanoides* (Namibia)  
*Crinum buphanoides* (Transvaal)  
*Crinum campanulatum* (South Africa)  
*Crinum carolo-schmidtii* (Namibia)  
[*Crinum carolo-schmidtii* x *C. americanum* x *C. macowanii*] x self  
*Crinum crassicaule* Baker (Namibia)  
*Crinum desert yellow* (South Australia)  
*Crinum distichum* (Tchad)  
*Crinum ereubescens* (Brazil, South America)  
*Crinum fimbriatulum* (Angola)  
*Crinum firmifolium* (Madagascar)  
*Crinum flaccidum* (north of Moree, NSW)  
*Crinum flaccidum* (south of Cunnamulla, QLD.)  
*Crinum flaccidum* (Wellington, NSW)  
*Crinum flaccidum* (West of Dubbo NSW)  
*Crinum forbesii* (Natal) & (Namibia)  
[*Crinum forbesii* x *C. macowanii* x *C. acaule*] x self  
(*Crinum forbesii* x *C. macowanii*) x (*C. macowanii* x *C. acaule*)  
(*Crinum graminicola* x *C. forbesii*) x *C. forbesii*  
(*Crinum graminicola* x *C. forbesii*) x self  
*Crinum hanitrae* (Madagascar)  
*Crinum hardyi* (Madagascar)  
*Crinum hildebrandtii* (Madagascar)  
*Crinum humilis* A. Chevalier (Cameroun)  
*Crinum jagus*  
*Crinum kirkii* (Tanzania)  
*Crinum* 'Kristin's Best Tan' (Lehmiller)  
*Crinum latifolium* (India)  
*Crinum lavrani* (Madagascar)  
*Crinum ligulatum* (Madagascar)  
*Crinum lineare* (South Africa)  
*Crinum loddigesianum* (Mexico)  
*Crinum lugardiae* (Namibia)  
*Crinum affn luteolum* (Andamooka, South Australia)  
*Crinum luteolum* (Pichi Richi Pass, South Australia)  
*Crinum affn luteolum* (Oakden Hills, South Australia)  
*Crinum macowanii* (Kenya)  
*Crinum macowanii* (South Africa)  
*Crinum macowanii* (Zambia)  
*Crinum mauritianum* (Madagascar)  
*Crinum mccoysi* (Madagascar)  
*Crinum modestum* (Itremo Mountains, Madagascar)  
*Crinum moorei* (Natal)  
*Crinum* 'Norma Justine' x self  
*Crinum oliganthum* 'Mini *Crinum*' (West Indies)  
*Crinum paludosum* (Natal)  
*Crinum paludosum* (Namibia)  
*Crinum pauciflorum* (Tchad)  
*Crinum pedunculatum* (Southern NSW Australia)  
*Crinum politifolium* (Tanzania)  
*Crinum procerum*  
*Crinum procerum* variegated  
*Crinum rautanenianum* (Namibia)  
*Crinum razafindratsiraea* (Madagascar)  
*Crinum roperensis* (Australia)  
*Crinum* 'Royal White' x self  
*Crinum scabrum*  
*Crinum* species undescribed Ethiopia  
*Crinum* species undescribed Madagascar = (*C. rubromarginatum*)  
*Crinum* species undescribed Northern Territory, Australia = (*C. kakaduensis*)  
*Crinum strictum* sensu Howard (Mexico)  
*Crinum subcernuum* (Mozambique)  
*Crinum* 'Temptation' x *C. 'Enchantress'*  
*Crinum uniflorum* (Australia)  
*Crinum uniflorum* large form (Australia) = (*C. yorkensis*)  
*Crinum variabile* (Cape)  
*Crinum variabile* x *C. bulbispermum*  
*Crinum affn venosum* (Australia)  
*Crinum verdoorniae* (Zambesi River)  
*Crinum* 'White Bouquet'  
*Crinum* 'White Queen' x self (Luther Burbank original)



- Crinum xerophilum* (Madagascar)  
*Crinum yuccaeides* (Cameroun)  
*Crinum zeylanicum*  
*Crocasmia* 'Lucifer'  
*Curcuma sumatrana*  
*Cybistetes longifolia* (South Africa)  
*Cypella coelestis*  
*Cypella lahue*  
*Crytanthus brachyscyphus*  
*Crytanthus elatus* x *C. montanus*  
*Crytanthus falcatus*  
*Crytanthus flammousus* (South Africa)  
*Crytanthus mackenii*  
*Crytanthus obliquus* (South Africa)
- Daubenya aurea* var *aurea*  
*Dietes butcheriana*  
*Dietes vegeta*  
*Dracunculus canariensis*  
*Dyckia rariflora*
- Echnocactus texensis*  
*Ermerus*  
*Eryngium bourgatii*  
*Erythrina crista-galli*  
*Erythrina crista-galli* 'Red Clouds'  
*Erythina herbacea*  
*Eucharis formosa* (south of Tarapoto, Peru)  
*Eucomis bicolor*
- Firmiana simplex*  
*Freesia laxa*  
*Fritillaria pallidiflora*
- Gladiolus communis* var *byzantinus*  
*Gladiolus primulinum*  
*Gladiolus scullyi*  
*Gloriosa superba*  
*Gloriosa superba* var *rothschildiana*  
*Gloriosa superba* var *carsonii*  
*Gloriosa wilhelmina* (green strain)
- Habranthus brachyandrus*  
*Habranthus* x *floryi*  
*Habranthus martinezii*  
*Habranthus robustus*  
*Habranthus* 'Russell Manning'  
*Habranthus texanus*  
*Habranthus tubispathus* (andersonii)  
*Haemanthus albiflos* (South Africa)
- Haemanthus barkerae*  
*Haemanthus coccineus*  
*Haemanthus deformis*  
*Haemanthus humilis* (pink)  
*Haemanthus humilis* var *humilis*  
*Haemanthus lanceifolius*  
*Helicodiceros muscivorus*  
*Hedychium* 'Daniel Weeks'  
*Hedychium* pink (bicolor)  
*Hedychium* 'Filigree'  
*Hemerocallis citrina*  
*Hemerocallis hypoxis*  
*Hemerocallis longituba*  
*Hesperaloe campanulatus* (Agavaceae)  
*Hibiscus coccineus* alba  
*Hibiscus grandiflora*  
*Hibiscus militaris* (Texas)  
 x*Hippeastreli*a 'Wilhelmina Prasek' x self  
 x*Hippeastreli*a 'Wilhelmina Prasek' x *Sprekelia*  
     *howardii*  
*Hippeastrum angustifolium*  
*Hippeastrum aulicum* var *robustum*  
*Hippeastrum blossfeldiae*  
*Hippeastrum brasilianum*  
*Hippeastrum cybister* 'Chic' x self  
*Hippeastrum cybister* x *H. aglaiae* x  
     *H. brasiliensis*  
*Hippeastrum* 'Durga Pradhan'  
*Hippeastrum* EAE x *H. parodii* x *H. aglaiae* x  
     *H. brasiliensis*  
*Hippeastrum* EAE x *H.* 'Pink Floyd'  
*Hippeastrum* EAE x *H.* 'Ruby Meyer'  
*Hippeastrum* 'Firefly' x self  
*Hippeastrum* 'Grandeur' x self  
*Hippeastrum* 'Great Dutch la Forest' x self  
*Hippeastrum harrisonii*  
*Hippeastrum* 'La Paloma' x self x self  
*Hippeastrum leonardii* (Peru)  
*Hippeastrum* 'Limona' x self  
*Hippeastrum* mixed hybrids  
*Hippeastrum* 'Moonlight' x self  
*Hippeastrum neopardinum* x *H. blossfeldiae*  
*Hippeastrum neopardinum* x *H. cybister* x  
     *H. papilio*  
*Hippeastrum neopardinum* x *H. neoleopoldii*  
*Hippeastrum neopardinum* x *H. papilio* x  
     *H. neopardinum*  
*Hippeastrum neopardinum* x *H. vittatum*  
*Hippeastrum neopardinum* x *H. EAE* x  
     *H. papilio*

- Hippeastrum papilio*  
*Hippeastrum papilio* x (*H. cybister* x *H. papilio*)  
*Hippeastrum papilio* x *H. teyucuarensis*  
*Hippeastrum parodii*  
*Hippeastrum puniceum*  
*Hippeastrum red hybrids*  
*Hippeastrum striatum*  
*Hippeastrum striatum* var *saltao* (Brazil)  
*Hippeastrum teyucuarensis*  
*Hippeastrum tucumanum* (Sahuc #12)  
*Hippeastrum vittatum*  
*Hosta plantaginiae*  
*Hymenocallis* aff. *harrisiana*  
*Hymenocallis arenicola*  
*Hymenocallis astrostephana* (Mexico)  
*Hymenocallis acutifolia* (Chiapas, Mexico)  
*Hymenocallis azteciana* (Mexico)  
*Hymenocallis chiapasiana* (Mexico)  
*Hymenocallis coronaria*  
*Hymenocallis durangoensis* (Mexico)  
*Hymenocallis eucharidifolia* (Mexico)  
*Hymenocallis franklinensis*  
*Hymenocallis galvestonensis*  
*Hymenocallis glauca* (Mexico)  
*Hymenocallis graminifolia* (Mexico)  
*Hymenocallis guerreroensis*  
*Hymenocallis harrisiana* (Mexico)  
*Hymenocallis howardii* (Mexico)  
*Hymenocallis imperialis* 'Big Fatty'  
*Hymenocallis lehmleri* (Mexico)  
*Hymenocallis lirisme*  
*Hymenocallis littoralis*  
*Hymenocallis maximilianii*  
*Hymenocallis occidentalis*  
*Hymenocallis palmeri* (Florida)  
*Hymenocallis pimana* (Mexico)  
*Hymenocallis proterantha* (Mexico)  
*Hymenocallis riparia* (Mexico)  
*Hymenocallis rotata*  
*Hymenocallis sinaloaensis* (Mexico)  
*Hymenocallis sonorensis* (Mexico)  
*Hymenocallis species* (Mexico)  
*Hymenocallis unknown species* (Guatemala)  
*Hypoxis rooperi*  
  
*Ipomoea cordatotriloba*  
*Ipomoea hederacea*  
*Iris delavayi*  
*Iris tectorum*  
*Iris tridentata* (Florida)
- Ismene* 'Festalis'  
*Ixia maculata*  
*Ixia polystachya*  
  
*Kniphofia baurii* (South Africa)  
*Kniphofia thompsonii* var *snowdenii*  
*Kniphofia tysonii*  
*Kosteletzkya virginica*  
*Lachenalia pusilla*  
*Lachenalia pustulata* (blue)  
*Lagerstroemia indica* (mixed)  
*Ledebouria galpinii*  
*Leucojum aulumnale*  
*Libertia grandiflora*  
*Lilium* 'Black Beauty'  
*Lilium candidum*  
*Lilium* 'Golden Dragon'  
*Lilium hybrids* (mixed)  
*Lilium regale*  
*Lupinus polyphyllus*  
*Lupinus villosus*  
*Lycoris aurea* (3 strains)  
*Lycoris sprengeri*  
*Lysiloma watsonii*  
  
*Macrozamia communis* (NSW, South Australia)  
*Manfreda undulata* (Agaveaceae)  
*Manfreda variegata*  
*Mirabilis jalapa* (white)  
*Moraea racemosa*  
*Moraea species* (apricot flowers)  
*Moraea stewartae*  
*Moraea polyanthus*  
*Muscari* 'Mount Hood'  
*Muscari species & hybrids*  
*Muscari* 'Valerie Finnis'  
  
*Narcissus papyraceus*  
*Nerine bowdenii*  
*Nerine undulata* (white flowers)  
  
*Ornithogalum lebaense* (Southwest Angola)  
  
*Pancratium mauritimum*  
*Passiflora Incarnata*  
*Penstemon species*  
*Phaedranassa carmiolii*  
*Phaedranassa species*  
  
*Radermacher sinica* (china doll tree)

*Rauhia decora*  
*Rauhia staminosa*  
*Rhododendron calendulaceum*  
*Rhodocodon* species (Madagascar)  
*Rhodophiala bifida* var *spathecea*  
*Romulea engleri*  
  
*Sabal blackburniana*  
*Sabal causiarum*  
*Sabal palmetto*  
*Sagittaria graminea*  
*Scadoxus* 'Konig Albert'  
*Scadoxus membranaceus*  
*Scadoxus multiflorus* ssp *multiflorus*  
     (Botswana)  
*Scadoxus puniceus*  
*Scilla peruviana*  
*Schizobasis intricata*  
*Sesbania punicea* (Scarlet Wisteria)  
*Solanum quitoense* (Naranjilla)  
*Sophora secundiflora*  
*Sparaxis mixed*  
*Sprekelia formosissima* (Mexico)  
*Sprekelia howardii* (Mexico)  
*xSprekelianthes* x self  
*Stenomesson leucanthum* (formerly *Pucara*  
     *leucanthum*)  
*Strumaria tenalla* var. *orientalis*  
*Synnotia*  
*Synnotia villosa*  
*Syringodium* species  
 .  
*Tecoma stans* (Bignoniaceae)  
*Tecophilaea cyanocrocus* var *leichtlinii*  
*Tropaeolum argentinum*  
*Tulbaghia simmleri* (syn. *T. fragrans*)  
*Tulbaghia violacea*  
*Tulipa tarda*  
  
*Veltheimia bracteata*  
*Veltheimia capensis*  
*Veltheimia glauca*  
  
*Watsonia borbonica*  
  
*Zephyranthes atamasco* (Jackson County,  
     Florida)  
*Zephyranthes* 'Benidana'  
*Zephyranthes chlorosolen*  
*Zephyranthes citrina*

*Zephyranthes clintiae*  
*Zephyranthes/Cooperia morris-clintii*  
*Zephyranthes* 'El Cielo'  
*Zephyranthes* 'Horse Tail Falls'  
*Zephyranthes* 'Joann Trial' x self  
*Zephyranthes* 'Labuffarosa'  
*Zephyranthes* 'La Siberia'  
*Zephyranthes lindleyana* (Mexico)  
*Zephyranthes minima*  
*Zephyranthes primulina*  
*Zephyranthes pulchella*  
*Zephyranthes reginae*  
*Zephyranthes simpsonii*  
*Zephyranthes treatiae*  
*Zephyranthes verecunda*

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Clivia	Hymenocallis	Haemanthus	xAmarcrinum
Crinum	Cyrtanthus	Scadoxus nutans	Zephyranthes
Lachenalia	Grafted Gardenia varieties	Rhodophiala	Phaedranassa
Eustephia darwinii			Ismene
xSprekelianthes			Hedychium
Sprekelia			Velthemia
Figs Palms			Canna
xHowardara			Habranthus
			Hippeastrum
Strelitzia Vines			Calostemma purpurea
xHippeastrelia			Scadoxus puniceus 'Snow Flurry'
Amaryllis belladonna (select forms)			Scadoxus puniceus 'Yellow Splendour'
Heliconia schiedeana			Zantedeschia aethiopica
			Hymenocallis x macrostephana
Stenomesson Variegata	Aspidistra	Diets	Bessera elegans





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### ***Members of the International Bulb Society,***

Newhouse would like to express our sincere appreciation for one of our all-time favorite customers, the International Bulb Society. Originally formed as American Amaryllis Society on May 21, 1933, the IBS published its first yearbook in 1934. The inaugural publication was called, appropriately enough, YEAR BOOK, AMERICAN AMARYLLIS SOCIETY, Volume 1. Now eighty years later, the society has decided to publish their final printed edition of what is now called HERBERTIA, Volume 66.

On behalf of Newhouse, I want to personally thank both Mr. Herb Kelly Jr., President of IBS, and Dr. David J. Lehmiller, Editor of HERBERTIA, for the honor and privilege to partner with publishing this very last printed edition of HERBERTIA. What began as a professional relationship in 2010, Newhouse has built a special friendship with both Mr. Kelly and Dr. Lehmiller. To say the least, we have truly enjoyed our small role in producing such an outstanding publication. As we print this final edition of the HERBERTIA publication, we simply say thank you for the opportunity to have served and for the friendships that we have built.

Regards,

**John Carpenter** /// *President*

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NOTES